

PUBLIC ROADS

A JOURNAL OF HIGHWAY RESEARCH

FEDERAL WORKS AGENCY
PUBLIC ROADS ADMINISTRATION

U. S. GOVERNMENT PRINTING OFFICE 1941
COLLECTION LIBRARY

VOL. 22, NO. 4



JUNE 1941



ON U.S. 101 NEAR SAN LUIS OBISPO, CALIF.

PUBLIC ROADS

►►► *A Journal of
Highway Research*

Issued by the
FEDERAL WORKS AGENCY
PUBLIC ROADS ADMINISTRATION

D. M. BEACH, *Editor*

Volume 22, No. 4

June 1941

The reports of research published in this magazine are necessarily qualified by the conditions of the tests from which the data are obtained. Whenever it is deemed possible to do so, generalizations are drawn from the results of the tests; and, unless this is done, the conclusions formulated must be considered as specifically pertinent only to described conditions.

In This Issue

	Page
Planning the Interregional Highway System	69
State Motor-Fuel Consumption and Tax Receipts, 1940	97
State Motor-Vehicle Registrations and Receipts, 1940	99

THE PUBLIC ROADS ADMINISTRATION - - - - - Willard Building, Washington, D. C.
REGIONAL HEADQUARTERS - - - - - Federal Building, Civic Center, San Francisco, Calif.

DISTRICT OFFICES

DISTRICT No. 1. Oregon, Washington, and Montana.	Post Office Building, Portland, Oreg.	DISTRICT No. 8. Alabama, Georgia, Florida, Mississippi, and Tennessee.	Post Office Building, Montgomery, Ala.
DISTRICT No. 2. California, Arizona, and Nevada.	Federal Building, Civic Center, San Francisco, Calif.	DISTRICT No. 9. Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.	76 State St., Albany, N. Y.
DISTRICT No. 3. Colorado, New Mexico, and Wyoming.	254 New Customhouse, Denver, Colo.	DISTRICT No. 10. Delaware, Maryland, Ohio, Pennsylvania, and District of Columbia.	Willard Building, Washington, D. C.
DISTRICT No. 4. Minnesota, North Dakota, South Dakota, and Wisconsin.	907 Post Office Building, St. Paul, Minn.	DISTRICT No. 11. Alaska.	Room 419, Federal and Territorial Building, Juneau, Alaska.
DISTRICT No. 5. Iowa, Kansas, Missouri, and Nebraska.	711 U. S. Courthouse, Kansas City, Mo.	DISTRICT No. 12. Idaho and Utah.	Federal Building, Ogden, Utah.
DISTRICT No. 6. Arkansas, Louisiana, Oklahoma, and Texas.	Room 502, United States Courthouse, Fort Worth, Tex.	DISTRICT No. 13. West Virginia.	Montgomery Building, Spartanburg, S. C.
DISTRICT No. 7. Illinois, Indiana, Kentucky, and Michigan.	South Chicago Post Office Building, Chicago, Ill.	DISTRICT No. 14. North Carolina, South Carolina, Virginia, and West Virginia.	

Because of the necessarily limited edition of this publication it is impossible to distribute it free to any person or institution other than State and county officials actually engaged in planning or constructing public highways, instructors in highway engineering and periodicals upon an exchange basis. At the present time additions to the free mailing list can be made only as vacancies occur. Those desiring to obtain PUBLIC ROADS can do so by sending \$1 per year (foreign subscription \$1.50), or 10 cents per single copy to the Superintendent of Documents, United States Government Printing Office, Washington, D. C.

PLANNING THE INTERREGIONAL HIGHWAY SYSTEM¹

BY THE DIVISION OF HIGHWAY TRANSPORT, PUBLIC ROADS ADMINISTRATION

Reported by H. E. HILTS, Assistant Chief, Division of Highway Transport

THE concept of an interregional highway system is no startling innovation to the highway builders of this country. Since the first settlers landed on American shores, people have been dreaming of it and building it.

The construction of routes that form the basic outline of the interregional system (fig. 1) has been quickened by the advent of gas-driven vehicles whose owners have been farsighted enough to join in reasonable cooperation in financing by public investment the highway plant that is now one of the world's wonders. To those who have lived in this era the highway plant has seemed to grow at an uncommonly leisurely pace largely because Americans are, in the main, a restless, creative people.

Now the main highway network is practically all surfaced and, in order to attain major benefits promptly for both civil and military requirements, it seems logical to plan and carry out a program of betterments and new construction on routes carrying large volumes of swiftly moving traffic between the country's main population centers. This was probably the impelling reason when the Congress included in the Federal Highway Act of 1938 a provision, section 13, which directed the Chief of the Bureau of Public Roads to investigate and to report to the Congress on the feasibility of building and operating as toll roads six express highways.

The results of the investigation undertaken pursuant to this instruction were published in *Toll Roads and Free Roads*, House Document No. 272, 76th Congress, First Session. From the discussion in that report there emerged a general outline of what was called A Master Plan for Free Highway Development. The consummation of this plan calls for the full cooperation of the Federal and State Governments. The program outlined in that report includes the following five points:

1. The construction of a special, tentatively defined system of direct interregional highways, with all necessary connections through and around cities, designed to meet the requirements of the national defense in time of war and the needs of a growing peacetime traffic of longer range.
2. The modernization of the Federal-aid highway system.
3. The elimination of hazards at railroad grade crossings.
4. An improvement of secondary and feeder roads, properly integrated with land-use programs.
5. The creation of a Federal Land Authority empowered to acquire, hold, sell, and lease lands needed for public purposes and to acquire and sell excess lands for the purpose of recoupment.

This paper deals with the general problems encountered in a tentative study of the first point together with some remarks on an emergency modernization of the tentatively defined interregional system and the elimination of hazards at grade crossings on the system.

29,330 MILES INCLUDED IN INTERREGIONAL SYSTEM

The system shown in figure 1 and tentatively selected after close cooperation with State and Federal agencies includes substantially all of the major interregional lines of travel. The system is 29,330 miles in length, of which 25,554 miles are rural in character and 3,776 miles are in urban territory. Figure 2 shows that it serves substantially all of the major population centers and the belts of heaviest population.

Traffic maps of the routes to be improved, given in figures 3 and 4, show the routes as the most heavily traveled, on the whole, of all the routes in the U. S. numbered system of highways. Improved as a system of largely limited-access free roads, it will attract traffic and generate new activities. To show how the traffic builds up in cities, the traffic flow has been plotted vertically in profile form and is shown in figure 5.

The existing rural routes most nearly conforming to the direct routes of the interregional system (figs. 6 and 7) now serve almost 11 percent of the total vehicle-miles of travel on all rural highways. Although their length represents only about 1 percent of the total rural highway mileage of the country, it is estimated that the completed system would unquestionably accommodate at least 12.5 percent of the total rural vehicle mileage. By providing ample capacity and up-to-date safety devices these free roads would effect a material reduction in the highway accident rate.

In the data submitted in this paper the direct routes follow the alignment and incorporate the improvements of existing highways with deviations from direct routes between population concentrations in limited degree only to accommodate the largest intermediate towns.

The routes are assumed to join facilities that will promote free movement of traffic to and through the centers of the cities. At large cities, wherever necessary, limited-access belt lines will have to be provided. All small communities are assumed to be bypassed. The two conditions cited are premised upon whether the city or town contributes either (1) the larger, or

¹ Paper presented at the Twentieth Annual Meeting of the Highway Research Board, December 1940.



FIGURE 1.—EXISTING HIGHWAYS FOLLOWING THE APPROXIMATE ALINEMENT OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM.

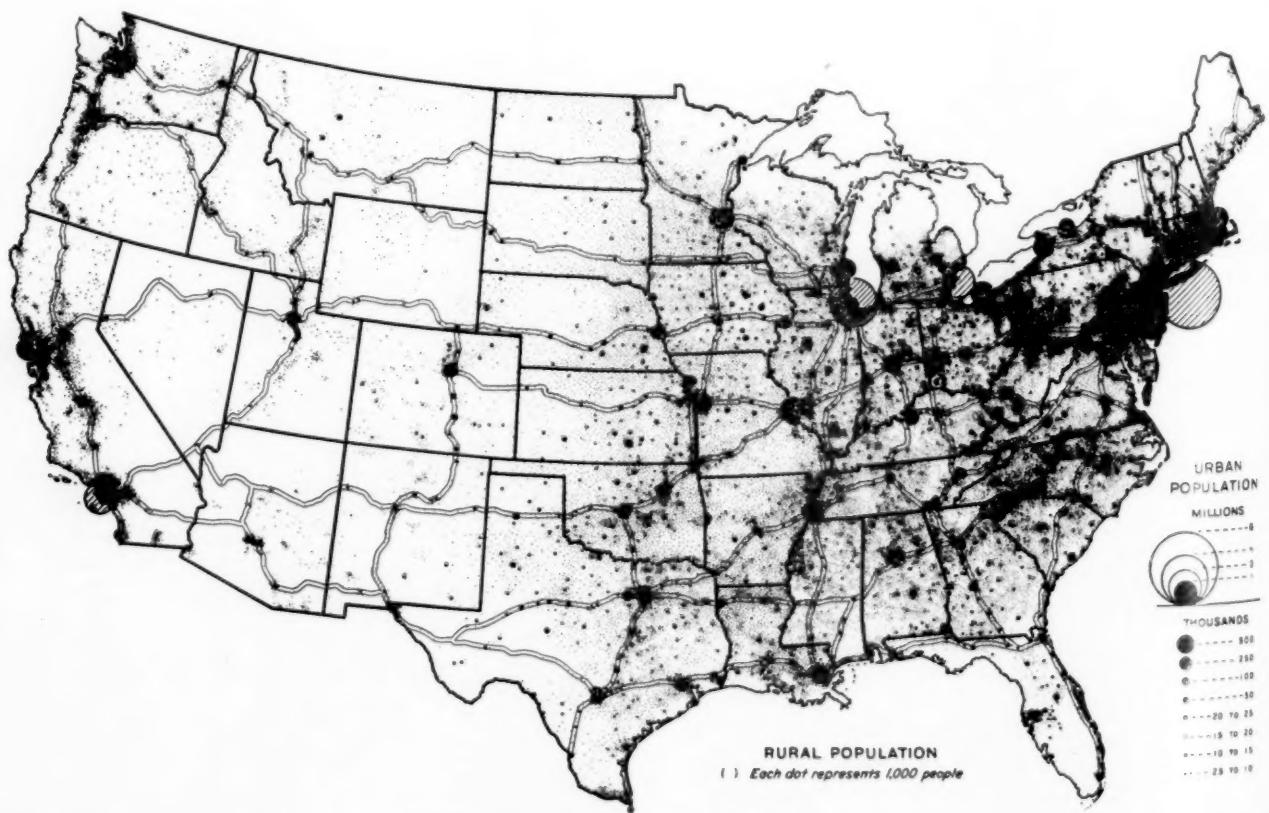


FIGURE 2.—POPULATION DISTRIBUTION IN RELATION TO THE LOCATION OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM.

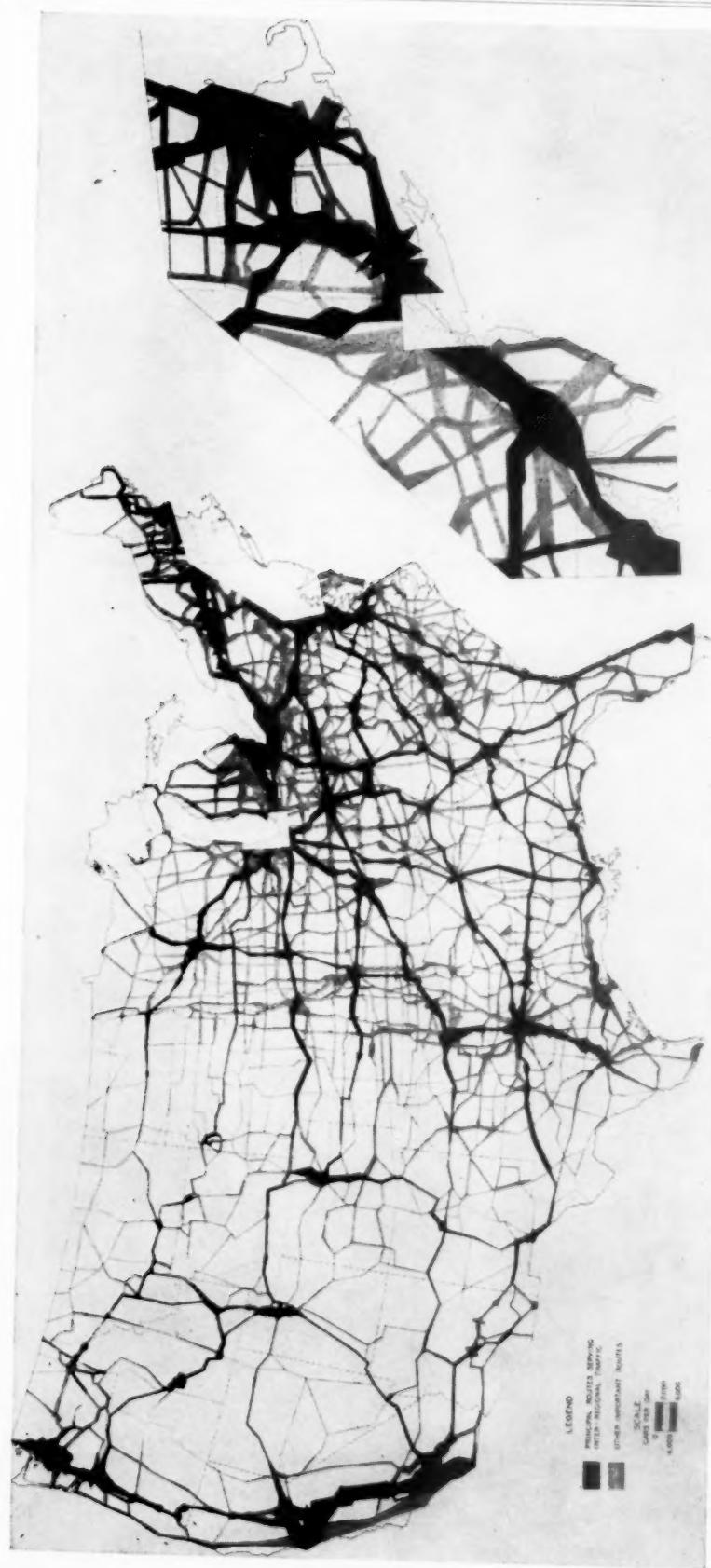


FIGURE 3.—COMPARISON BETWEEN THE AVERAGE DAILY PASSENGER-CAR TRAFFIC ON THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM AND THAT ON OTHER IMPORTANT ROUTES, 1937 DATA.

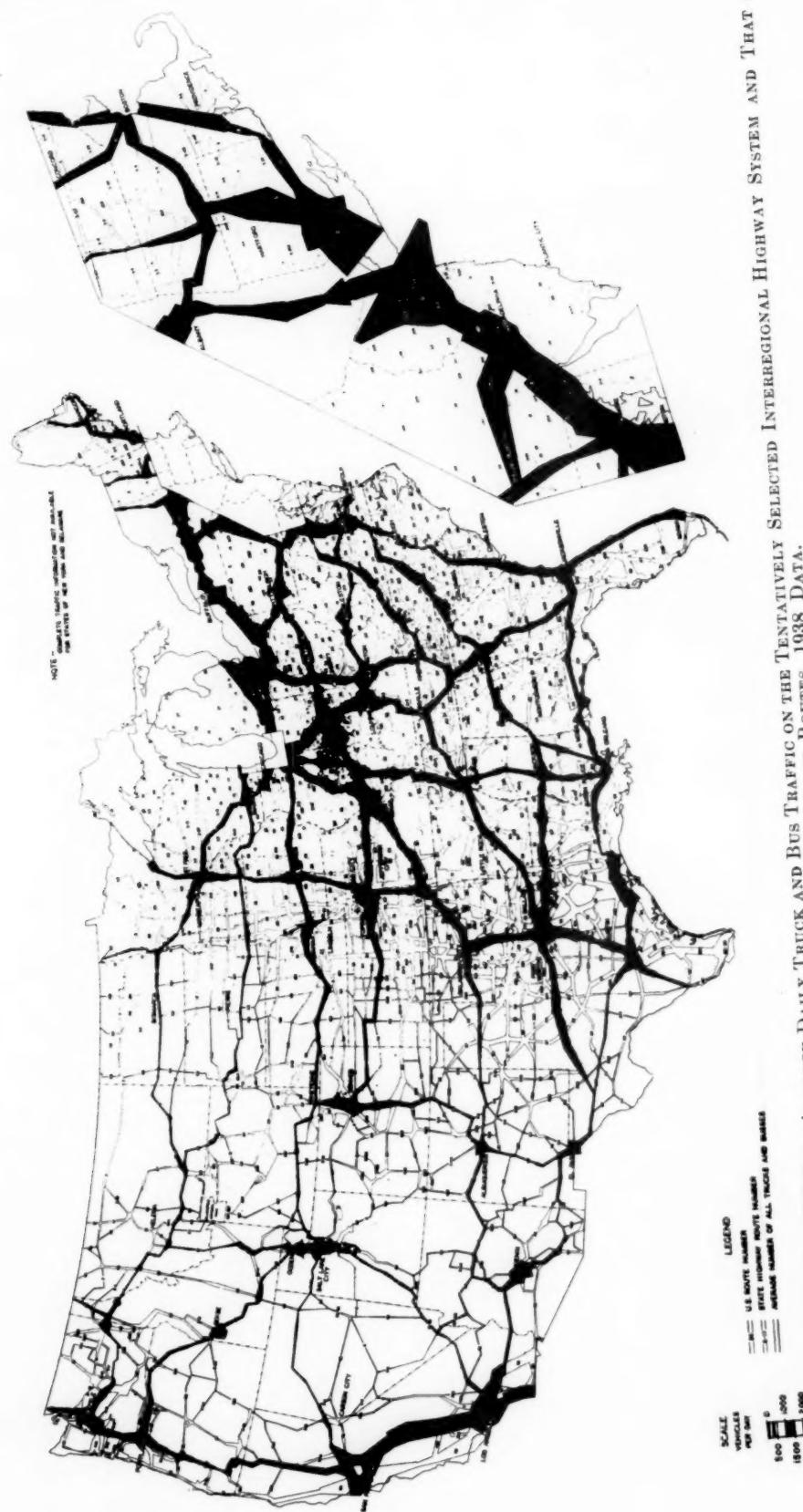


FIGURE 4.—COMPARISON BETWEEN THE AVERAGE DAILY TRUCK AND BUS TRAFFIC ON THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM AND THAT ON OTHER IMPORTANT ROUTES, 1938 DATA.

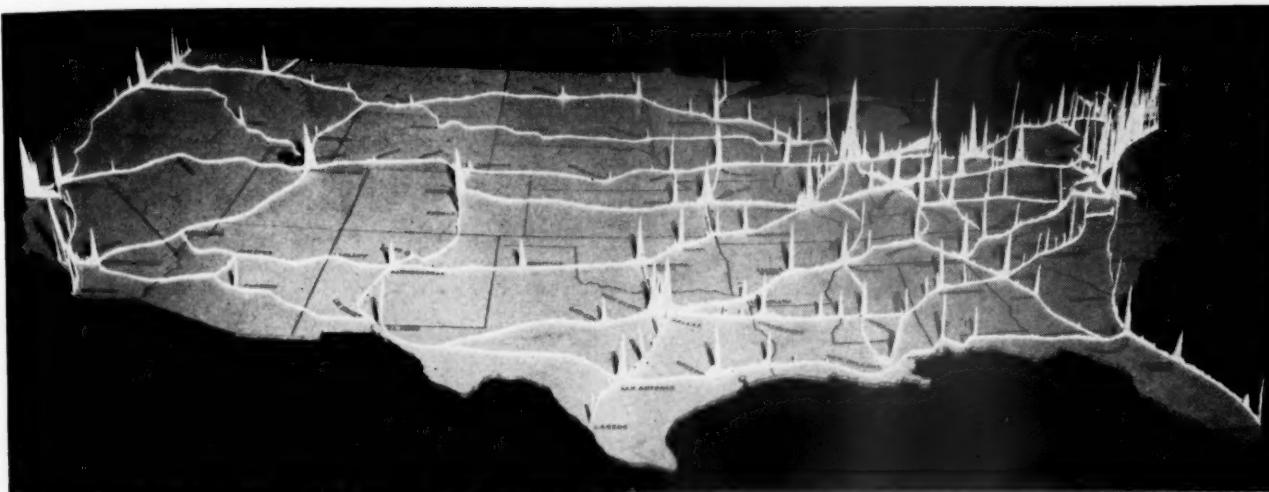


FIGURE 5.—TRAFFIC FLOW PROFILE OF THE TENTATIVE INTERREGIONAL HIGHWAY SYSTEM, 1937 DATA.

(2), the smaller part of the expected traffic on the route at its boundaries.

In general, the main rural highways of the Nation, beyond the immediate vicinity of the cities, are of sufficient capacity to discharge the flow of present traffic.

If a slight restriction of absolute freedom of movement is accepted, which is to be expected on the rural highways during short periods of maximum hourly traffic volume that occur in the course of a year, an average daily volume of 3,000 vehicles may be considered as within the reasonably convenient discharge capacity of a 2-lane highway.

On this basis, figure 8 shows the portions of the interregional system now having only two lanes which should be widened. Sections now having four or more lanes are also shown in figure 8. To emphasize the contrast, figure 9 has been prepared to show only the existing sections having four or more lanes. These data were obtained by analysis of diagrams that will be discussed later. They have been prepared for the entire tentative interregional system, first, between route intersections, and second, as continuous routes between main city termini. These diagrams show the main physical and operating characteristics of the entire system. An analysis of these diagrams (table 1) shows that on the tentative system, 1,230 miles of more than 2-lane width are within 25 miles of municipalities having populations exceeding 100,000, of which 500 miles are 3-lane width and 730 miles are 4-lane width. The traffic data (table 2) show that to provide adequate traffic facilities, 1,770 additional miles of more than 2-lane width should be constructed within 25 miles of the larger municipalities, and 1,230 additional miles should be constructed on the remaining part of the rural interregional system.

The traffic standards suggested above contemplate the construction of roads greater than two lanes in width when the present average daily traffic volume exceeds 3,000 vehicles. For the purpose of this discussion it is assumed that 4-lane divided highways will be built at locations having present average traffic volumes of from 3,000 to 10,000 vehicles per day. Should the present average volume exceed 10,000 vehicles per day, it might be that special conditions would

require still wider pavements, but such requirements should be determined by analysis of each case rather than by resort to a general standard.

TABLE 1.—*Present lengths of sections of the tentative interregional highway system having more than 2 lanes, located within 25 miles of cities of more than 100,000 population*

Geographic division	Lengths having 3 lanes		Lengths having 4 lanes or more		Total
	Miles	Miles	Miles	Miles	
New England.....	80	90	170		
Middle Atlantic.....	140	130	270		
East North Central.....	80	150	230		
West North Central.....	30	70	100		
South Atlantic.....	70	90	160		
East South Central.....	10	30	40		
West South Central.....	10	60	70		
Mountain.....			10	10	
Pacific.....	80	100	180		
United States.....	500	730	1,230		

TABLE 2.—*A comparison between the length of sections of the tentative interregional highway system requiring widths in excess of 2 lanes and the length of the existing sections having more than 2 lanes*¹

Geographic division	Length of sections requiring more than 2 lanes		Length of sections both requiring and now having more than 2 lanes		Length of sections requiring widening	
	Loc- ated within 25 miles of cities	Loc- ated beyond 25 miles of cities	Loc- ated within 25 miles of cities	Loc- ated beyond 25 miles of cities	Loc- ated within 25 miles of cities	Loc- ated beyond 25 miles of cities
New England.....	390	180	170	70	220	110
Middle Atlantic.....	560	450	260	160	300	290
East North Central.....	540	280	200	100	340	180
West North Central.....	210	80	40	80	170	
South Atlantic.....	430	240	150	160	280	80
East South Central.....	100	30	150	10	90	30
West South Central.....	220	190	40	30	180	160
Mountain.....	90	60	10	40	80	20
Pacific.....	270	610	160	250	110	360
United States.....	2,810	2,120	1,040	890	1,770	1,230

¹ The determination of need is based on the assumption that routes carrying in excess of 3,000 vehicles per day should be wider than 2 lanes.² Length of sections now having more than 2 lanes and carrying more than 3,000 vehicles per day.

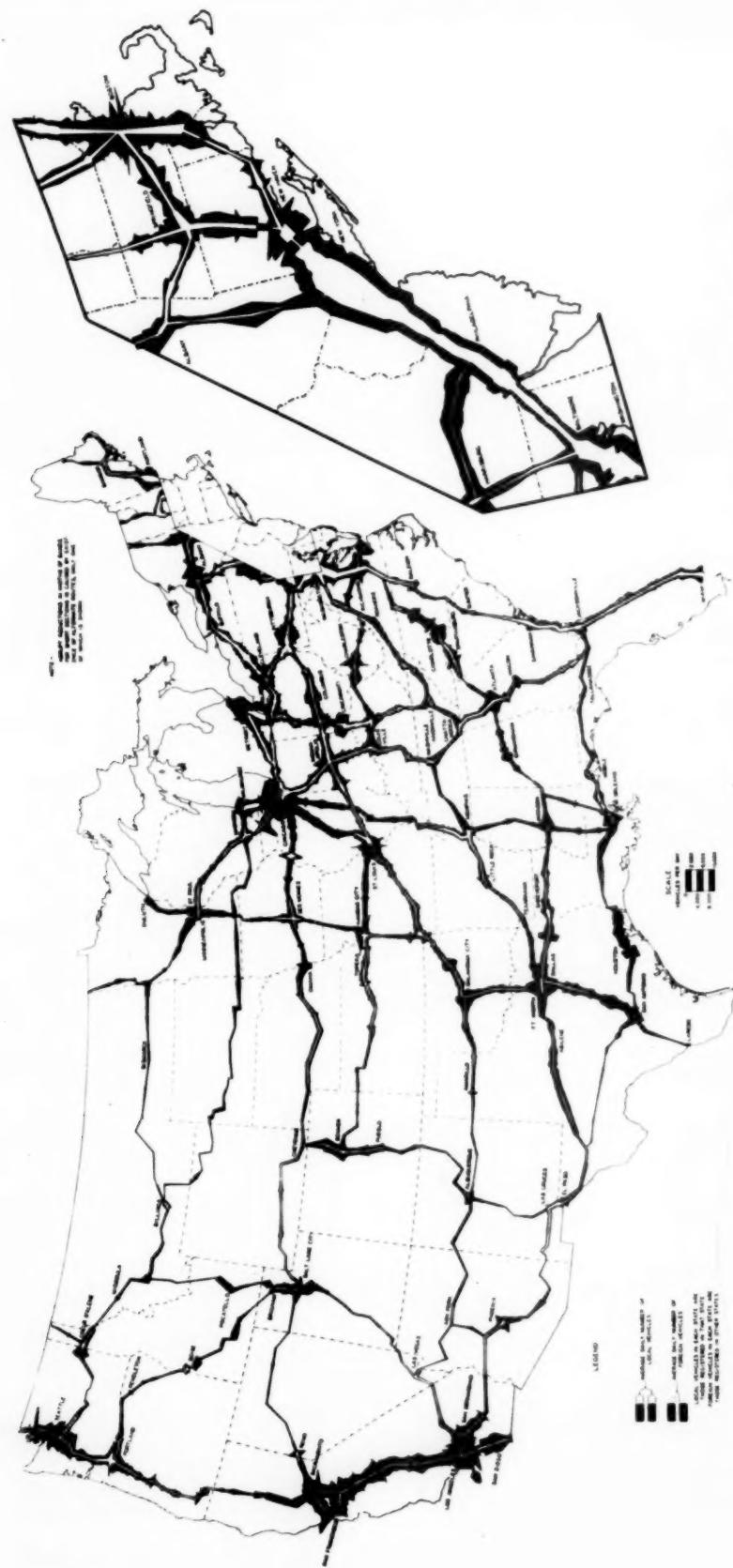


FIGURE 6.—THE AVERAGE DAILY PASSENGER-CAR TRAFFIC ON THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM, 1937 DATA.

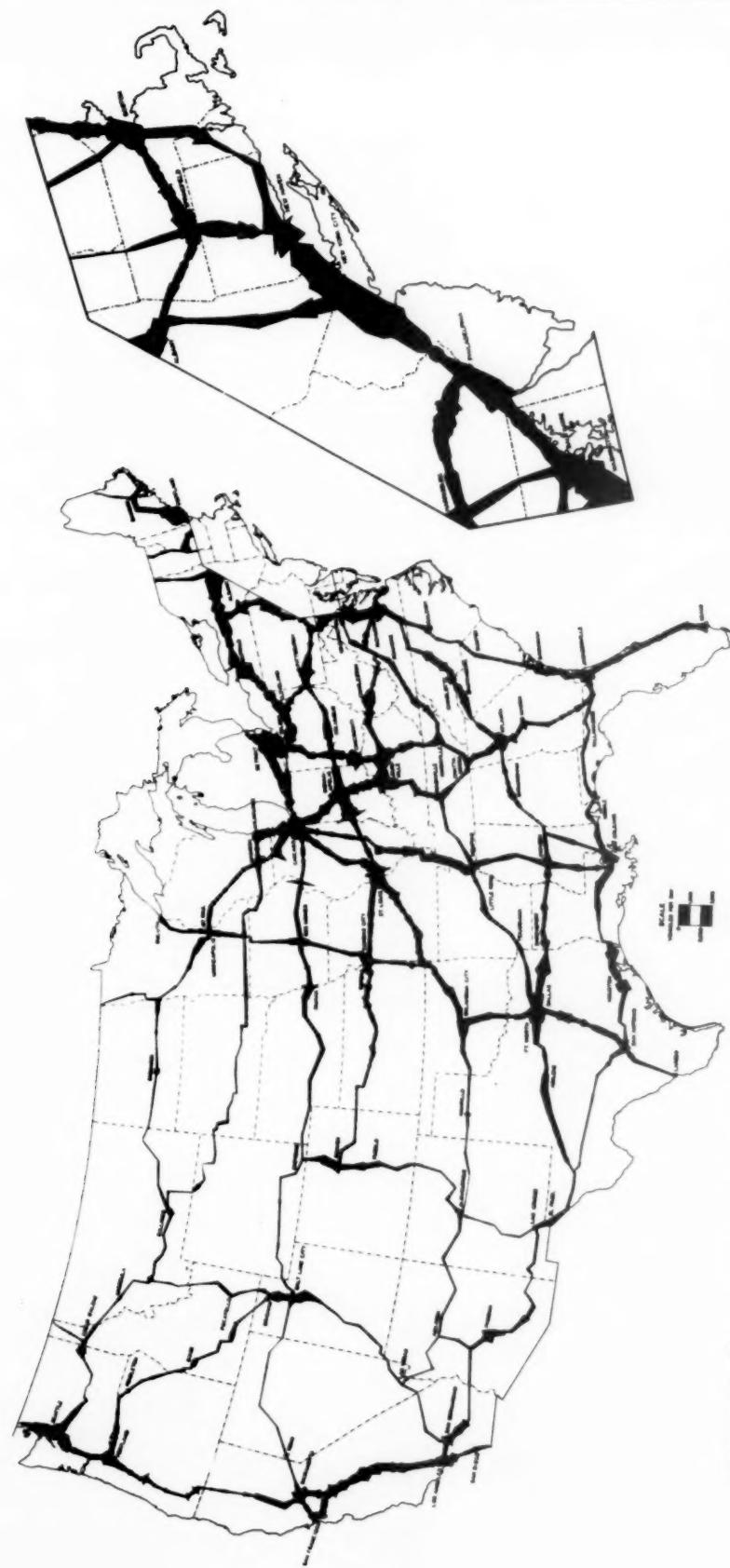


FIGURE 7.—THE AVERAGE DAILY TRUCK AND BUS TRAFFIC ON THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM, 1937 DATA.

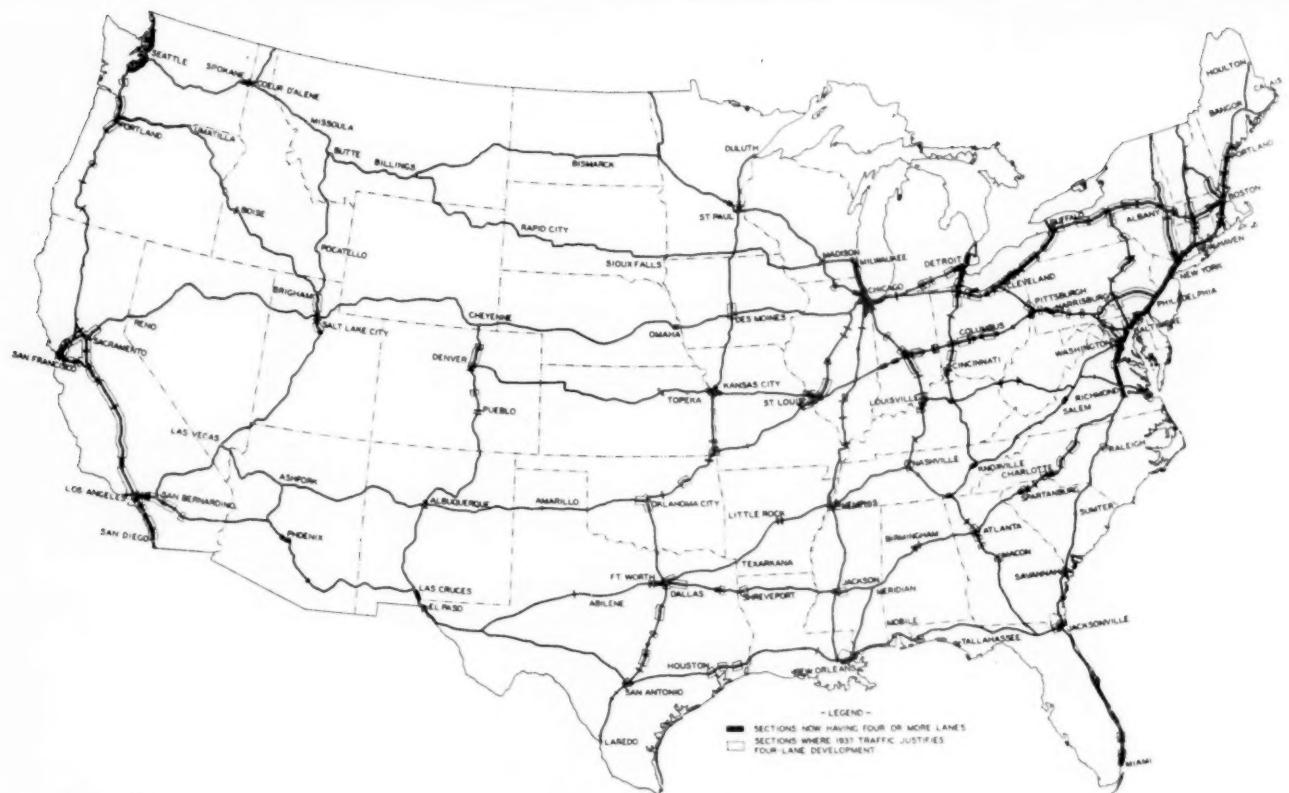


FIGURE 8.—LOCATION OF SECTIONS OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM HAVING FOUR OR MORE LANES, AND OTHER SECTIONS WHERE 1937 TRAFFIC DATA INDICATE THE NEED OF IMPROVEMENT TO FOUR-LANE STANDARDS.

PEAK TRAFFIC GREATLY EXCEEDS AVERAGE TRAFFIC VOLUME

By correlating the analysis of the complete records of 89 fixed-type automatic traffic counters, selected from a total of some 500 now in operation, with the analysis of speed and passing distance studies made on 28 sections of 2-lane highway in Virginia, Maryland, Massachusetts, New York, Connecticut, and Illinois, and on 8 sections of 4-lane undivided highway and 5 sections of 4-lane divided highway in Massachusetts, New York, and Illinois, the following present general résumé appears reasonable. During certain periods of the year, and particularly on weekends, the daily traffic will far exceed the average. On roads with an average daily volume of 3,000 vehicles it may be expected that on 1 day each year the volume will reach 7,300 vehicles, and that on the 10 days of heaviest traffic the daily volume will exceed 5,700 vehicles. This latter figure corresponds to what might be expected on a normal summer Sunday.

On the average road carrying an average daily volume of 10,000 vehicles, the maximum daily volume will probably reach 18,500 vehicles, and on the tenth highest day, or the summer Sunday condition, the daily volume may be expected to be 15,000 vehicles. That volumes in this range require special analysis is shown by the fact that on one road, a modern 4-lane divided highway corresponding to the design proposed for the interregional system, an average traffic of 10,000 vehicles per day resulted in a peak day's flow of 24,000 vehicles, and on the 10 days of highest traffic volume, the daily flow exceeded 19,000 vehicles. Either special conditions induced these larger peaks, or the road's design permitted a traffic movement more nearly corresponding to the desires of the traveling public. The latter explanation is quite reasonable.

when it is considered that the peaks on this road are in the same proportion to the average daily flow of 10,000 as they are on the other roads with but 3,000 vehicles per day. Undoubtedly, congestion caused by poor alignment, intersections, and other restrictive features deters some travel and tends to lengthen the peak periods and thus to lower the peaks.

The significance of these figures is emphasized by translating them to terms of hourly traffic density and measures of congestion. On the average highway carrying an average daily volume of 3,000 vehicles, it may be expected that during 1 hour of the year the volume will be 750 vehicles, and during the 10 hours of heaviest flow the volume will exceed 550 vehicles per hour. As a result of studies on selected average 4-lane roads it is estimated that with an average traffic of 10,000 vehicles per day, the maximum volume in any 1 hour during the year will be 1,750 vehicles, and for 10 hours the flow will exceed 1,450 vehicles per hour.

On the more modern road with its sharper traffic peaks, the hourly volume will reach 2,500 vehicles, and for 10 hours the flow will exceed 1,800 per hour. Since the 4-lane roads will be divided, however, the traffic in each direction will be of greater importance than the total. For an entire day the traffic in one direction will nearly equal that in the other. For individual hours, however, as much as 70 percent of the total may be in one direction. Average roads, with average traffic of 10,000 vehicles per day, thus will carry some 1,200 vehicles in one direction during the heaviest hour, while the road permitting free travel will be required to accommodate 1,750 vehicles in one direction during 1 hour of the year. With these traffic standards, vehicles will be able to move with very little



FIGURE 9.—LOCATION OF SECTIONS OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM HAVING FOUR OR MORE LANES.

restriction to speed even during the hour of heaviest flow.

Studies have been made on 12 sections of 2-lane road tangents with only minor restrictions in alignment and grade beyond the limits of the sections under study in Massachusetts, New York, and Illinois. According to records obtained on the best of these sections, vehicle speeds in the periods of lightest traffic will generally average between 42 and 45 miles per hour, with 10 percent of the vehicles traveling at 52 to 54 miles per hour or faster. With an hourly rate of 750 vehicles, the worst condition that may be expected on 2-lane roads, the average speeds will range from 39 to 42 miles per hour, with 10 percent of the vehicles moving at 48 to 50 miles per hour or faster. The average difference in speed between successive vehicles (designated herein as the congestion index), which is a measure of the freedom of movement, decreases from around 8 miles per hour in the lightest traffic to 5 or less at a rate of 750 vehicles per hour. Shifting from a 2-lane to a 4-lane divided road at this volume of 750 vehicles per hour, corresponding to 3,000 vehicles per day, the average speed increases to 47 miles per hour or faster, with 10 percent of the vehicles moving at 58 miles per hour or faster; and the congestion index shows a speed difference between vehicles of about 8 miles per hour.

Studies made on the best of four sections of road in two States indicate that as the average volume increases to 10,000 vehicles per day on an undivided 4-lane road on which the traffic is not retarded by intersections and roadside establishments, the maximum anticipated hourly volume of 1,200 vehicles in one direction would move at an average speed of 40 miles per hour, with 10 percent exceeding 54 miles per hour and the congestion index

would become about 7 miles per hour. On modern 4-lane divided highways on which the sharper peaks will be expected, the maximum hourly rate in one direction may reach 1,750 vehicles per hour, but it is likely that the speeds will equal or exceed the values listed above for 1,200 vehicles per hour.

CHARTS SHOW PHYSICAL CONDITION OF SYSTEM

Figure 10 shows a portion of the interregional system from near Los Angeles to Sacramento, California. Distance on the diagram is represented by a very small scale. Beginning at the top, 1937 traffic density for the route is shown in terms of annual average 24-hour volume classified as total traffic, total trucks and busses, and that portion of the total that is classified as foreign (carrying out-of-State registration tags). Below traffic are shown the number of fatal accidents per mile and their location to the nearest mile. Below fatal accidents the number of restricted sight distances are given per individual mile classified as permanent or temporary. The number of sight distances shown are those in each individual mile that are shorter than desirable limits of 1,000 feet and 650 feet in non-mountainous and mountainous areas, respectively. Below sight distance data are shown the number of grades longer than 500 feet in each individual mile exceeding 5 percent in non-mountainous areas and 8 percent in mountainous areas, considered generally as desirable maximum limits.

Below grade data are represented to the indicated scale the number of curves in each individual mile of the highway that in 1937 were sharper than certain indicated desirable standards, generally 6 degrees in non-mountainous areas and 14 degrees in mountainous areas.

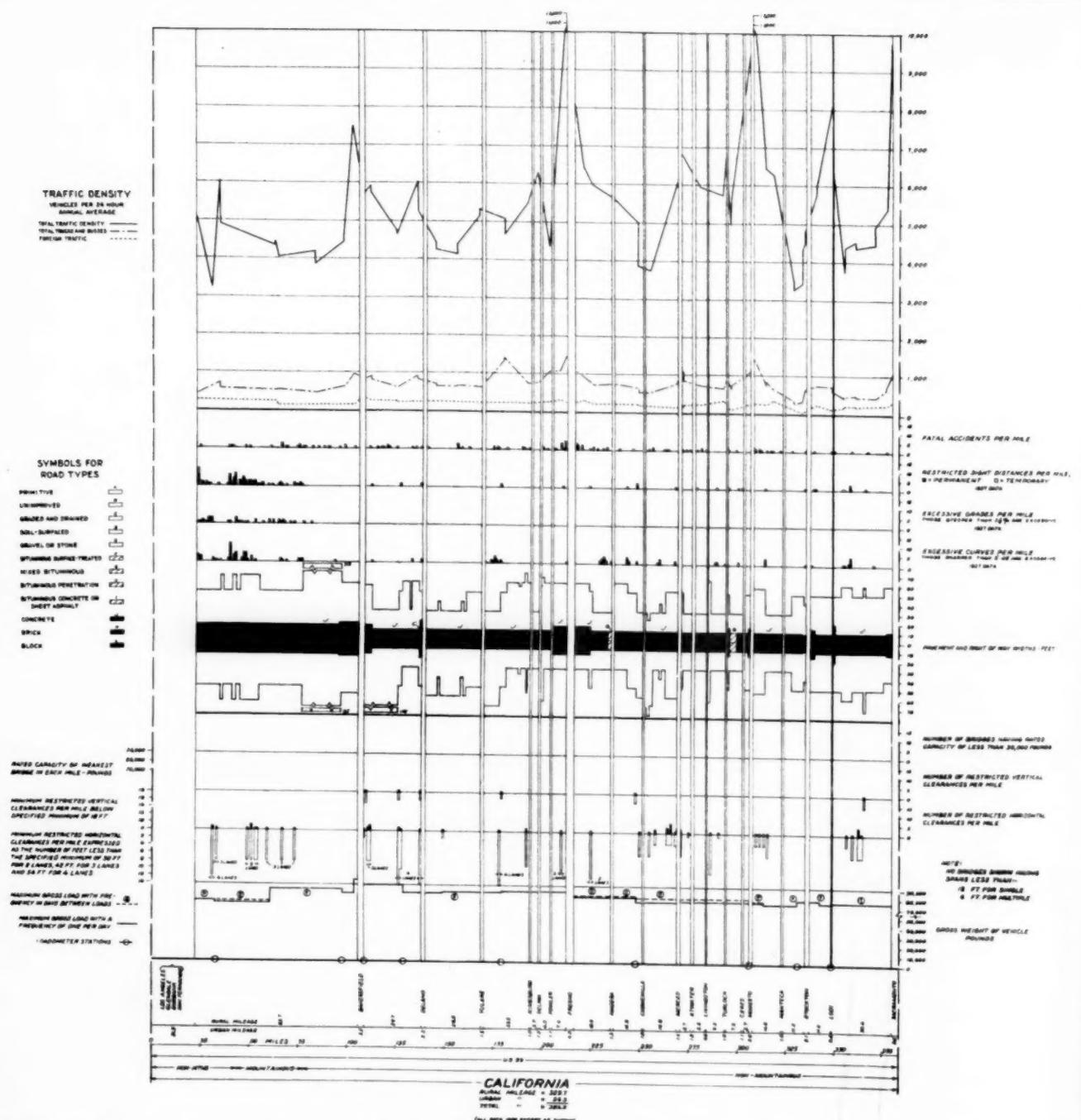


FIGURE 10.—TRAFFIC PROFILES, LIMITING PHYSICAL COMPONENTS OF THE ROAD, AND LIMITING FEATURES OF BRIDGES FOR A SECTION OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM.

Below the curve data are shown pavement and right-of-way widths in feet. The character of the highway surface is represented by the shading or hatching within the broad bands extending across the diagram. The width of the pavement or surface on each mile is represented to the indicated scale by the width of the hatched band. The right-of-way width is shown to the same scale.

Below pavement and right-of-way width follow data on the number per mile of bridges having rated capacities of less than 30,000 pounds, and the rated capacity of the weakest bridge in each mile; the number per mile

of restricted vertical clearances less than 18 feet, and the minimum vertical clearance in the mile; the number of restricted horizontal clearances per mile, and the minimum horizontal clearances per mile expressed as the number of feet less than the specified base width of 30 feet for 2 lanes, 42 feet for 3 lanes, and 54 feet for 4 lanes. The lowest data on the diagram show the maximum gross loads in pounds for the sections involved, based on the data for the loadometer stations located as shown by the circles on the lowest line. The maximum gross loads are shown for 1-day frequency by a solid line and for frequency in the number of days as

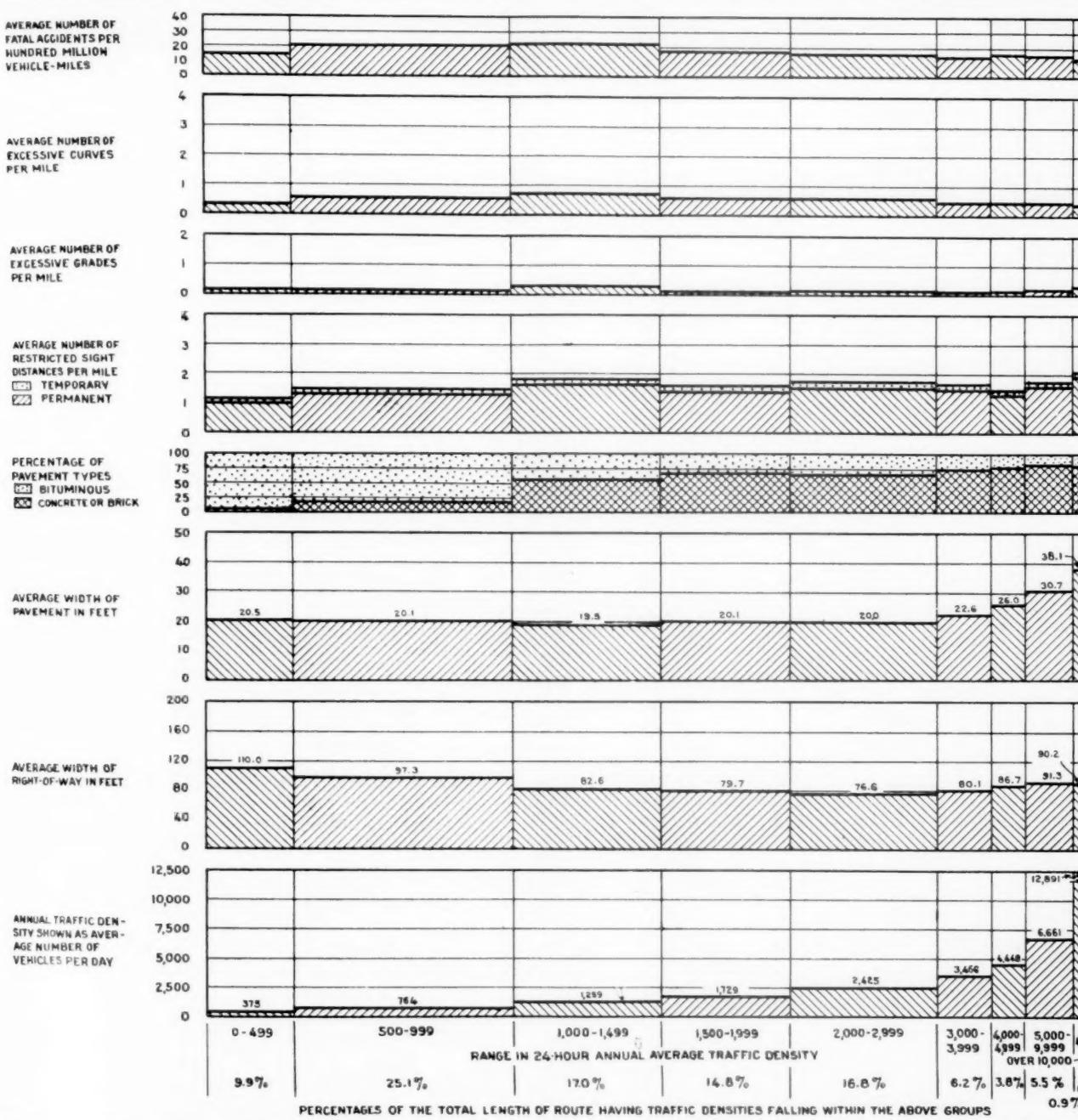


FIGURE 11.—SUMMARY OF PHYSICAL CONDITIONS ON RURAL SECTIONS OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM ARRANGED IN TRAFFIC VOLUME GROUPS.

indicated by the number within the circle by a broken line.

Below the diagram are shown the rural mileage, the urban mileage, a mileage scale, the U. S. route number, and the classification of the route into mountainous and non-mountainous.

Figure 11 is a summary of all the physical conditions on the existing mileage of rural sections of the tentative interregional system arranged in traffic-volume groups. This chart shows that 9.9 percent of the total rural mileage carries less than 500 vehicles per day, 25.1 percent carries between 500 to 999 vehicles per day, etc. The horizontal width of the space for showing features within each of the various density groups is proportional to these percentages.

In the lowest space of the chart the average number of vehicles per day for all sections falling within each traffic-density group is plotted. Next above this is plotted the average width of right-of-way for all sections falling within each group. Other conditions are shown graphically in the same manner in the other spaces.

On those sections carrying less than 500 vehicles per day are found the widest right-of-way, a relatively wide pavement, the lowest percentage of concrete or brick pavement, the fewest restricted sight distances per mile, relatively few excessive grades per mile, the fewest excessive curves per mile, and a relatively low rate of occurrence of fatal accidents. In sharp contrast are those sections carrying from 1,000 to 1,499

vehicles per day where there are found a relatively narrow right-of-way, the narrowest pavement, slightly more than 50 percent of the concrete or brick pavement, a relatively large number of restricted sight distances, the greatest number of excessive grades per mile, the greatest number of excessive curves per mile, and the most frequent rate of occurrence of fatal accidents.

Many significant relationships are shown in figure 11. The narrowest right-of-way is found to exist for highway sections carrying 2,000 to 2,999 vehicles per day, the narrowest pavement for sections carrying 1,000 to 1,499 vehicles per day, the greatest percentage of concrete or brick pavement for sections carrying 5,000 to 9,999 vehicles per day, the greatest number of restricted sight distances for sections carrying more than 10,000 vehicles per day, the greatest number of excessive grades per mile for sections carrying 1,000 to 1,499 vehicles per day (but only slightly more than the number occurring on sections carrying more than 10,000 vehicles per day), the greatest number of excessive curves per mile for sections carrying 1,000 to 1,499 vehicles per day, and the greatest number of fatal accidents per hundred million vehicle-miles for sections carrying 1,000 to 1,499 vehicles per day. The safest sections are those carrying more than 10,000 vehicles per day. They are by far the most congested, carrying 340 vehicles per day per foot of width. The sections which rank second in safety are those carrying less than 500 vehicles per day, or only 18 vehicles per day per foot of width.

Charts of similar form have been prepared for each of the 20 longer routes of the system. Their comparison with the summary chart for the entire system indicates, in general, that routes in the southern part of the country are more dangerous than northern routes.

From available data, it is not possible to compare the accident rate on the rural interregional system with that for all rural highways. The accident figures shown have been expressed in terms of the number of fatal accidents per 100 million vehicle-miles of travel on the system in 1937. On the rural interregional system there were 16.04 fatal accidents per 100 million vehicle-miles. It has been estimated that about 1.2 persons were killed in each fatal rural highway accident in 1937. Assuming that this rate applies to the rural interregional system, it implies a death rate of about 19.2 per 100 million vehicle-miles during 1937. The National Safety Council reports that in 1937 there were 15.8 deaths per 100 million vehicle-miles on all rural roads and urban streets.

PAVEMENT AND RIGHT-OF-WAY WIDTHS INADEQUATE

Figure 12 is a summary chart showing the accumulative distribution of right-of-way widths by traffic density groups. From it there can be read directly the percentage of the aggregate length of all rural sections which carry less than any chosen number of vehicles per day and which have right-of-way widths less than any chosen width. For example, if it is assumed that a right-of-way width of 160 feet is desired for all rural sections of the system carrying less than 3,000 vehicles per day, the length of the system requiring additional right-of-way is shown to be 79.5 percent of the aggregate length of all rural sections.

Similarly, figure 13 shows the cumulative distribution of pavement widths. If it is assumed that a pavement

width of 22 feet is desired for all rural sections of the system carrying less than 1,000 vehicles per day (this is a liberal assumption for those roads that now carry less than 600 vehicles per day), the length of the system requiring additional pavement width is shown to be 30.1 percent of the aggregate length of all rural sections. If it is assumed that a pavement width of 24 feet is desired for all rural sections carrying less than 3,000 but more than 1,000 vehicles per day, the length requiring additional pavement width may be obtained by reading, on the vertical bar representing 24 feet, the intercept between the lines representing 1,000 and 3,000 vehicles per day. The length is shown to be 44.8 percent of the aggregate rural length.

A less direct use of figures 12 and 13 is the determination of the deficiency in the area of right-of-way or pavement for any desirable width for any traffic volume group. The area between the limits of the traffic volume group and to the left of the desired width is the deficient area which may easily be converted to acres or square yards.

There is no doubt that, as measured by the diagrams, unsatisfactory conditions with respect to sight distance, curvature, and gradient, are common. There is no doubt that present rights-of-way are largely inadequate. There seems to be generally a reasonable accord between traffic volume and the number of pavement lanes, the amount and character of the traffic, and the kind of pavement or surface in place, but there is inadequate width of pavement lanes on a considerable mileage, usually near cities. These inadequacies are the concomitant of construction operations carried on for more than 20 years, during which period top vehicle speeds have increased from 30 to well above 60 miles per hour. Then, too, when the oldest of the existing pavements were built there were only 2 or 3 million motor vehicles and there was a strong demand for hard surfaced roads to get the traffic through.

These conditions account for the present need for correction of sharp curvature, steep grades, and narrow surfaces and rights-of-way by reconstruction or by abandonment of such obsolete sections and relocating the highway.

The present need is to bring all of these interregional routes gradually up to a higher degree of usefulness by the reduction of excessive curvature, the easing of steep grades, the opening up of longer sight distances, the general widening of pavement lanes and the construction of additional lanes, the separation of opposing traffic on heavily traveled sections, arrangements for the accommodation of slow-moving traffic on steep grades, the separation of grades at railroad grade crossings and important highway intersections and the installation of protective cross traffic controls at others, the abatement of dangerous roadside conditions of all sorts, relocations for directness of travel between important objectives for serving the movements of longer range, and finally, the acquisition of new right-of-way of sufficient width to make all of these improvements possible.

During the next 20 years planning technique will be greatly improved. The determination of the required number of traffic lanes will probably not be determined on the basis of traffic density, but on the basis of some measures of traffic congestion, which will take into account the magnitude, duration, and frequency of occurrence of peak traffic loads, differences in speed of

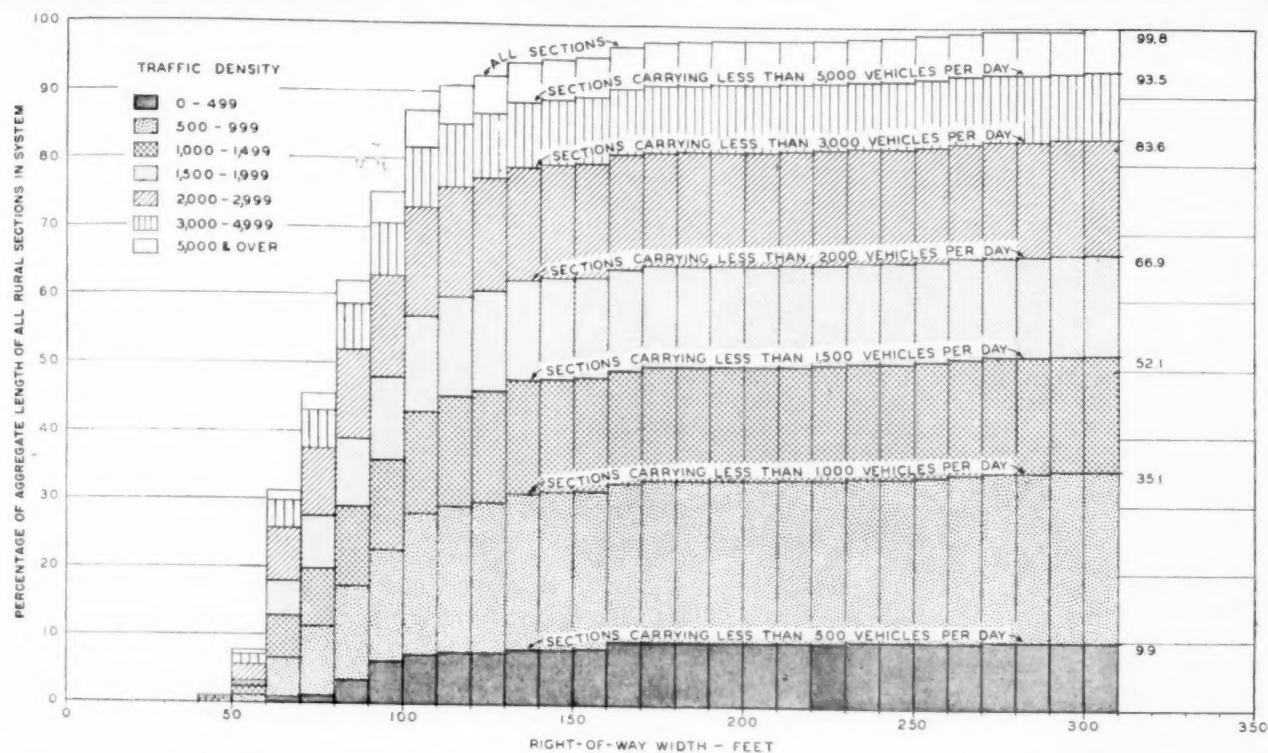


FIGURE 12.—CUMULATIVE DISTRIBUTION OF LENGTHS OF RURAL SECTIONS OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM HAVING VARIOUS RIGHT-OF-WAY WIDTHS AND TRAFFIC DENSITIES.

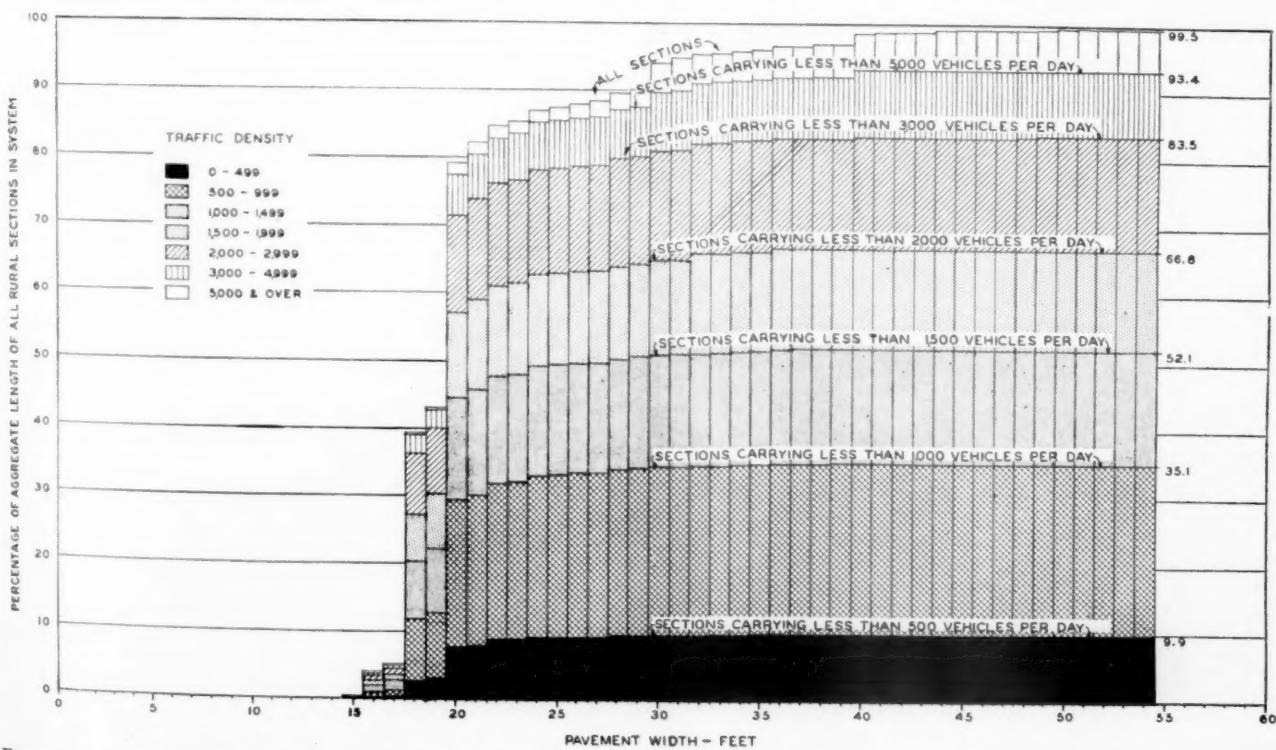


FIGURE 13.—CUMULATIVE DISTRIBUTION OF LENGTHS OF RURAL SECTIONS OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM HAVING VARIOUS PAVEMENT WIDTHS AND TRAFFIC DENSITIES.

travel, etc. Until uses of these measures of traffic congestion are perfected, the best basis for classification applicable to present available information is traffic density.

SECTIONS CLASSIFIED BY DAILY TRAFFIC VOLUME

For immediate planning purposes, all rural sections of the interregional system are classified into six groups as follows:

- Group I—Sections carrying less than 1,000 vehicles per day.
- Group II—Sections carrying 1,000 to 1,999 vehicles per day.
- Group III—Sections carrying 2,000 to 2,999 vehicles per day.
- Group IV—Sections carrying 3,000 to 4,999 vehicles per day.
- Group V—Sections carrying 5,000 to 9,999 vehicles per day.
- Group VI—Sections carrying 10,000 or more vehicles per day.

Design standards considered in this study of the interregional system are shown in table 3, and are based on the above classification of rural sections. The "present average daily traffic density" is considered to be the volume of traffic which follows the existing road immediately before the improvement is undertaken, plus the existing traffic then following other routes which would logically be diverted to the interregional road if the improvement were made. It does not include "generated traffic" which is generally defined as that traffic which results from a new desire for travel on the part of certain people who would not care to perform the same travel in the absence of the improved facility.

Groups I and II (traffic density 0-1,999) contain sections which cannot be expected to carry sufficient traffic to warrant construction to more than 2 lanes during the life of the new surface. The only difference in standards for sections in group I and those in group II is that a wider right-of-way is specified for the latter group. This additional right-of-way is justified by the

improved protection to traffic and by the fact that high right-of-way costs can be avoided on those sections which will become inadequate from the standpoint of service in the shortest time, thus placing them in line for widening when the new surface must be replaced.

Practically all of the sections in group III (traffic density 2,000-2,999) will be due for construction as 4-lane divided highways when the life of the new surface has expired. Some of them will be ready for this higher type of construction before that time. The same right-of-way widths are specified for this group of sections as are specified for sections in group II.

All of the sections in group IV (traffic density 3,000-4,999) are assumed to carry sufficient traffic to warrant their construction as 4-lane divided highways.

Four-lane divided highway construction is also specified for sections in group V (traffic density 5,000-9,999), but greater cost allowances are provided for the attainment of the desirable standards, and more rigid limits are specified for the permissible standards. Many of these sections may require widening before the new surface needs replacement.

Sections in group VI (traffic density in excess of 10,000) are assumed to require special design, usually requiring more than a 4-lane divided highway.

The design standards marked "desirable" in table 3 apply wherever the average cost per mile for a section of any considerable length, exclusive of the costs of right-of-way, property damage, large bridges, and railroad and highway grade separation structures, does not exceed the amounts shown in column 4 headed "cost limitation, desirable standards." In order to provide flexibility in these standards, three subclassifications, based on topography of the terrain traversed, are

TABLE 3.—*Interregional highway standards*

Classification of section	Present average daily traffic density	Type of topography	Cost limitation, desirable standards	Right-of-way width ¹						Shoulder widths ²						Width of normal median strip ³						Curvature ⁴	Grades						
				Minimum		Desirable		Without border control		With border control		Without border control		With border control		Minimum permissible		In excavation, outside of curve or on tangent		Minimum permissible		Rural humid areas		Rural arid areas		Suburban areas			
				Dollars	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Feet	Degree	Percent					
I	Less than 1,000	Relatively level	30,000	200	100	300	100	1-22	8	10	8	8	10	8	8	10	8	8	10	8	8	10	3	3	3	3			
			40,000	200	100	300	100	1-22	4	10	4	8	10	4	8	10	4	8	10	4	8	10	3	3	3	3			
II	1,000-1,999	Mountainous	60,000	200	100	300	100	1-22	4	10	4	8	10	4	8	10	4	8	10	4	8	10	3	3	3	3			
			40,000	200	7 160	300	7 160	1-24	8	10	8	8	10	8	8	10	8	8	10	8	8	10	3	3	3	3			
III	2,000-2,999	Relatively level	60,000	200	7 160	300	7 160	1-24	4	10	4	8	10	4	8	10	4	8	10	4	8	10	3	3	3	3			
			60,000	200	7 160	300	7 160	1-24	4	10	4	8	10	4	8	10	4	8	10	4	8	10	3	3	3	3			
IV	3,000-4,999	Mountainous	80,000	200	160	300	160	1-24	4	10	4	8	10	4	8	10	4	8	10	4	8	10	3	3	3	3			
			40,000	200	7 160	300	7 160	1-24	8	10	8	8	10	8	8	10	8	8	10	8	8	10	3	3	3	3			
V	5,000-9,999	Relatively level	60,000	200	7 160	300	7 160	1-24	4	10	4	8	10	4	8	10	4	8	10	4	8	10	3	3	3	3			
			100,000	240	160	300	240	1-24	8	10	8	10	10	8	10	10	8	10	10	8	10	10	3	3	3	3			
VI	10,000 or more	Relatively level	150,000	240	240	300	240	2-24	4	10	4	8	12	6	12	32	32	32	32	32	32	3	3	3	3				
			200,000	240	240	300	240	2-24	4	10	4	8	6	6	6	25	25	25	25	25	25	3	3	3	3				
	Relatively level	Mountainous	225,000	240	240	300	240	2-24	8	10	8	10	10	8	10	10	8	10	10	8	10	10	4	4	4	4			
			250,000	240	240	300	240	2-24	8	10	8	10	10	8	10	10	8	10	10	8	10	10	5	5	5	5			
	Relatively level	Mountainous	300,000	240	240	300	240	2-24	8	10	8	10	10	8	10	10	8	10	10	8	10	10	5	5	5	5			
			Rolling	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	{	4	4	4				
	Mountainous		Mountains	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	{	5	5	5	5			

¹ Additional right-of-way to be provided where required to accommodate grading. Border control consists of State control of development of strip of land adjacent to the right-of-way for the purpose of eliminating objectionable features without necessarily preventing cultivation of arable land.

² Number and width of individual 2-lane pavements. All multiple parallel 2-lane pavements shall be separated by a median or dividing strip of land.

³ Design of shoulders and median or dividing strips shall be consistent with recommendations contained in A Policy on Highway Types, 1940.

⁴ Exclusive of widening for guardrail.

⁵ Inside of curves, maintain a uniform distance of 24 feet from centerline of 2-lane highway to toe of cut slope at ditch bottom, except unwidened curves on grade tangents where 22 feet will be permitted. Carry uniform slope from pavement edge to bottom of ditch. Provide comparable widths for 4-lane divided highways. Provide adequate foundation and stabilized surface for all shoulders.

⁶ Vertical curves are to be designed as specified in the appendix.

⁷ In relatively level and rolling terrain, 100 feet of this width should run continuously on 1 side of centerline.

⁸ Special design.

⁹ Not specified.

introduced, each carrying a specific cost limitation. These are designated "relatively level," "rolling," and "mountainous."

Wherever construction to desirable standards would exceed these amounts, the standards to be applied are relaxed, but not further than indicated in the columns headed "maximum" or "minimum," except in rare instances.

DESIGN STANDARDS DESCRIBED IN DETAIL

Right-of-way widths.—The desirable width of right-of-way for all rural sections is shown to be 300 feet, except where the principles of border control can be employed. Border control consists of State control of development of a strip of land adjacent to the right-of-way for the purpose of eliminating objectionable features without necessarily preventing cultivation of arable land. Agreements for such control may even include an option to buy the adjacent strips at some future time. Where border control can be obtained, the sum of the right-of-way width and the controlled width should be equal to the right-of-way widths shown in the columns headed "without border control." It should be noted that for 2-lane highways, the border control principle will permit reductions in required right-of-way widths to as little as one-third to one-half the width otherwise required, and on such highways, where old alignments are followed, the additional right-of-way width required would often be small.

Where right-of-way costs are abnormally high and border control principles cannot be employed, minimum widths are specified, consisting of 200 feet for 2-lane highways, and 240 feet for 4-lane divided highways.

Pavement widths.—Pavement widths are shown to be 22 feet for traffic densities of less than 1,000 vehicles per day, and 24 feet for traffic densities of 1,000 to 2,999. Divided highways having two roadways each 24 feet in width are specified for traffic densities of 3,000 to 9,999 vehicles per day.

Shoulder and median strip widths.—Shoulder widths of 8 feet in cut and 10 feet in fill are generally specified as desirable. Minimum requirements permit widths of 8 feet in terrain classified as relatively level, and 4 feet in terrain classified as rolling or mountainous.

The design of shoulders and median strips is to be consistent with recommendations contained in A Policy on Highway Types, published by the American Association of State Highway Officials.

Curvature and grades.—Curves of 3 degrees and grades of 3 percent are specified as desirable for all topography and all groups of highway sections and should control the design wherever the estimated cost is less than the limitations appearing in column 4 of table 3. In topography classified as relatively level, no departure from this requirement is permitted, even though the cost should exceed the limitation. For sections carrying less than 1,000 vehicles per day and located in mountainous country, 10-degree curves and 6-percent grades are specified. The standards become increasingly severe for more heavily traveled routes, reaching limits of 5 degrees and 5 percent for mountainous sections carrying more than 5,000 vehicles per day.

Sight distances.—The main controllable features of the highway which restrict sight distances may be classified as cut banks on horizontal curves, and hill crests. At night, sight distance is also limited by the rate of change of the profile elevations in sags, which affects the point at which headlamp rays strike the road surface. At the present time, specifications for lengths of vertical curves in sags are incomplete.

The limiting degree of horizontal curvature must usually be selected on the basis of a number of economic considerations, only one of which is the extent to which desirable sight distances can be provided. Once the specifications for horizontal alignment and cross sections are settled, the sight distances limited by cut banks on horizontal curves are fixed. Obviously, no advantage to the traveling public can be gained by increasing lengths of vertical curves occurring on horizontal curves beyond those lengths required to provide sight distance equal to that afforded by the horizontal curve. There is, therefore, no justification for construction expenditures for this purpose. For sections of the highway located on tangent and short horizontal curves where sight distance is not restricted by cut banks but by hill crests, vertical curves should be designed as described in the Appendix, page 95.

INTERREGIONAL STANDARDS COMPARED WITH EMERGENCY MILITARY STANDARDS

Highway grade separations are to be designed to conform with the recommendations contained in A Policy on Highway Types published by the American Association of State Highway Officials in 1940. For sections of the interregional highway carrying less than 3,000 vehicles per day and designed with two traffic lanes, grade separations are specified for all intersecting highways carrying more than 500 vehicles per day. Grade separations are also to be used at all railroad crossings. Intersecting roads carrying between 200 and 500 vehicles per day at the time the interregional improvement is constructed will cross at grade employing the design principles contained in A Policy on Highway Types and A Policy on Intersections at Grade.

For sections of the interregional system carrying between 3,000 and 10,000 vehicles per day and where a 4-lane divided highway is specified, grade separations are specified at all railroad intersections and at all intersecting highways carrying more than 200 vehicles per day. Intersecting roads carrying less than 200 vehicles per day will cross the interregional road at grade by means of special designs conforming to the recommendations contained in A Policy on Highway Types. For sections of the interregional system carrying more than 10,000 vehicles per day, grade separations are assumed for all railroad intersections and all intersecting highways left open for public use. Minor intersecting roads are to be closed to public use unless more than 200 vehicle-miles per day of additional travel are required for existing traffic to use an adjacent grade separation structure.

The foregoing discussion relates entirely to design standards for complete modernization of the interregional system. It will be interesting to compare these standards with the standards recently specified for emergency conditioning of principal routes of military importance. In these recent emergency standards provision is made for strengthening of weak bridges having ratings of less than H-15, widening of the narrowest bridges having horizontal clearance of less than 18 feet, increasing the vertical clearances of structures now having less than 12½ feet vertical clearance, widening pavements having surfaces less than 18 feet wide, widening shoulders to 8- or 10-foot widths wherever practical and improving surfaces which are not all-weather, dustless, or designed in accordance with present practice of individual States for repeated application of the 9,000-pound pneumatic wheel load.

The emergency standards provide for the improve-

ment of all weak bridges to withstand H-15 loadings in rural areas and H-20 loadings in metropolitan areas. They provide for the increase of all vertical clearances less than $12\frac{1}{2}$ feet to a minimum of 14 feet. Where pavement widening is necessary, specified new pavement widths are 20 feet for sections carrying less than 600 vehicles per day, 22 feet for sections carrying 1,600 to 1,799 vehicles per day, and 24 feet for sections carrying more than 1,800 vehicles per day. Where horizontal clearances on bridges are less than 18 feet, the standards specify their widening to a minimum of 4 feet in excess of the pavement widths specified, and preferably 6 feet in excess of these widths. Where horizontal clearances at underpasses are less than 18 feet, the standards specify their widening to a minimum of 30 feet, and preferably to a width equal to the new pavement widths specified plus shoulder widths.

Except in mountainous terrain where heavy grading is encountered, the standards specify the widening of all shoulders that are now less than 8 feet to a minimum width of 8 feet, and preferably to a width of 10 feet, wherever widening of shoulders can be undertaken economically. Where such widening is financially impractical or where sufficient right-of-way cannot be obtained without difficulty, the standards specify as a minimum requirement that 8- to 10-foot shoulders about 2,000 feet long be provided at 4-mile intervals on the same side of the highway. It is recommended in the standards that such intermittent shoulders be staggered on both sides in order to make emergency parking spaces available in one direction or the other at 2-mile intervals.

COST ESTIMATE BASED ON CLASSIFICATION OF SECTIONS IN ACCORDANCE WITH 1937 TRAFFIC DENSITY

For economic development, the improvement of the system must extend over a period of many years. Many existing sections improved to modern standards provide reasonably adequate service. The wisest course to follow is to improve each section to the interregional standards at the time when it can no longer continue to provide reasonably adequate service. On this basis, the worst sections will be improved first; therefore, sections in low traffic density groups as well as those in high traffic density groups will be placed under construction during the same year.

As the traffic density increases from year to year,



FIGURE 14.—CENSUS REGIONS OF THE UNITED STATES.

the sections will progress from one traffic density group to another. An estimate of cost, therefore, based on a classification of sections in accordance with present-day traffic densities would be low as compared with one which must be developed to represent the actual expenditures required over a period of years. Nevertheless, for planning purposes, an estimate based upon traffic density classifications for a selected year has considerable value in that it can be subdivided by economic regions to show the relative cost, by regions (fig. 14), of the development proposed. These regional costs can be compared with various economic indices to test the soundness of the proposal, and particularly the distribution of the proposed work among the various regions.

The cost of improving the rural sections of the interregional system to the design standards recommended, based upon a classification of sections in accordance with 1937 traffic densities, is shown in table 4. Grouped together are all rural sections in each geographic division for which the same number of traffic lanes are recommended. The estimated length of 2-lane sections is 21,237.3 miles, and the estimated construction cost is \$1,149,404,000, or \$54,100 per mile. The estimated length of 4-lane sections is 4,048.3 miles, and the estimated construction cost is \$741,447,000, or \$183,100 per mile. The estimated length of sections requiring special designs with more than 4 lanes is 268.6 miles, and the estimated construction cost is \$117,887,000, or \$438,900 per mile. Right-of-way

TABLE 4.—Estimated cost of improving rural sections of the interregional system

Geographic division	Less than 3,000 vehicles per day			3,000 to 10,000 vehicles per day			More than 10,000 vehicles per day			Total length	Total construction cost	15 percent allowance for engineering and contingencies	7.5 percent allowance for right-of-way	Total cost	Total cost per mile
	Length	Cost per mile	Estimated construction cost	Length	Cost per mile	Estimated construction cost	Length	Cost per mile	Estimated construction cost						
New England.....	Miles	1,000 dollars	1,000 dollars	Miles	1,000 dollars	1,000 dollars	Miles	1,000 dollars	1,000 dollars	Miles	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
Middle Atlantic.....	662.2	70	46,354	337.2	192	64,742	70.3	464	32,619	1,069.7	143,715	21,557	10,779	176,051	165
East North Central.....	383.0	70	26,810	609.6	270	188,892	102.6	540	55,404	1,185.2	271,100	40,666	20,333	332,115	280
West North Central.....	2,072.8	60	124,368	720.4	173	124,629	4.1	433	1,775	2,797.3	250,772	37,616	18,808	307,136	110
South Atlantic.....	3,516.6	60	175,830	233.4	151	35,243	4.3	250	1,075	3,754.3	212,148	31,822	15,911	259,881	60
East South Central.....	2,442.3	55	134,326	541.7	162	87,755	45.2	350	15,820	3,029.2	237,901	35,685	17,843	201,429	66
West South Central.....	1,873.1	50	93,655	128.9	161	20,753	6.2	300	1,860	2,002.0	114,408	17,161	8,581	140,150	70
Mountain.....	3,035.6	50	151,780	403.2	130	52,416	6.2	345.0	3,445.0	5,709.9	206,056	30,909	15,454	252,419	73
Pacific.....	5,566.9	50	278,345	143.0	133	19,019	35.9	260	9,334	44,605	297,364	22,302	304,271	64	337.213
United States.....	21,237.3	54	1,149,404	4,048.3	183	741,447	268.6	439	117,887	25,554.2	2,008,738	301,311	150,656	2,460,705	98

TABLE 5.—*Estimated cost of improving urban sections of the interregional system*

Geographic division	Length	Construction cost per mile	Estimated construction cost	15 percent allowance for engineering and contingencies	25 percent allowance for right-of-way	Total cost	Total cost per mile
New England.....	227.0	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
Middle Atlantic.....	407.1	1,052	428,269	64,240	107,067	599,576	1,473
East North Central.....	628.4	537	337,451	50,618	84,363	472,432	752
West North Central.....	452.5	385	174,212	26,132	43,553	243,897	539
South Atlantic.....	549.9	385	211,712	31,757	52,928	296,397	539
East South Central.....	320.9	365	117,128	17,560	29,282	163,979	511
West South Central.....	437.6	319	139,594	20,939	34,898	195,431	447
Mountain.....	371.5	275	102,162	15,324	25,541	143,027	385
Pacific.....	381.6	548	209,117	31,368	52,279	292,764	767
United States.....	3,776.5	504	1,902,834	285,425	475,708	2,663,967	705

costs for rural sections are estimated to be 7.5 percent of the construction costs, and an allowance for engineering and contingencies equal to 15 percent of the construction cost is made.

The estimated cost of improving urban sections is shown in table 5. There are 3,776.5 miles of urban sections, representing 12.9 percent of the total length of the system. The estimated construction cost is \$1,902,834,000, or \$503,900 per mile. Right-of-way costs are estimated to be 25 percent of this amount, and a further allowance of 15 percent of the construction cost is made for engineering and contingencies.

The estimated costs of urban sections are not sufficient to permit construction to theoretically ideal standards, but they are thought to be reasonable estimates of probable costs which would result from a general program aimed toward providing facilities as nearly approaching the ideal standards as practical, after reasonable compromises had been made. As one test of the consistency of the estimates for individual cities, the costs were reduced to a per capita basis. The estimates showed that per capita costs in large cities were lower than those in small cities. That this should be so is obvious when it is considered that the service rendered to a city by merely projecting the routes of the interregional system through it varies inversely with the population. This condition implies that attention should be directed to the need for extensive city development, which can be accomplished only in small part by the construction of the transcity connections of the interregional system. It emphasizes the fact that the larger the area of local congestion, the less is the amount of relief to be obtained merely by development of the system.

Even though the urban cost, including an allowance for right-of-way, exceeds the rural cost, this urban cost is estimated to be only about one-fifth of the expenditure which must be made to modernize completely all the main connecting thoroughfares in the cities traversed. Unless these additional and greater expenditures are made, the investment in the interregional route is threatened by the rapid obsolescence of urban portions of improved interregional routes which may be anticipated as a result of their attracting a disproportionately large share of traffic. This would probably lead to the outward development of the city further than would prove most economical to its interests. Only by construction of comparable facilities in other directions can the economic growth of cities, and the success of the interregional system itself, be assured.

In sharp contrast to the cost estimates for the improvement of the interregional system to recommended standards is the cost estimate for its improvement to

the standards recently specified for the emergency improvement of principal routes of military importance. Table 6 shows that the estimated cost of improving rural sections to recommended standards is about six times the cost of improvement to emergency standards. Although a cost estimate on the latter basis was not prepared for urban sections, it would not seem unreasonable to assume that the same relationship would exist between estimates prepared for the urban sections as is shown for the rural sections.

DISTRIBUTION OF SYSTEM COMPARED WITH VARIOUS ECONOMIC INDICES

The report *Toll Roads and Free Roads* suggests that the routes of the system be selected "without specific limitation in each State." Although the system described in this paper was selected on the basis of present traffic service to population concentrations and with particular reference to interregional coverage, it may be well to present certain economic facts and see how the selected tentative system measures up to these facts.

TABLE 6.—*A comparison of the estimated cost of emergency work with the estimated cost of improvement to recommended long-range standards for rural sections of the interregional system*

Geographic division	Length of rural sections	Estimated construction cost of improving interregional system		Ratio of cost of emergency work to the cost based on long-range standards
		Using recommended long-range standards	Using standards recommended for emergency work	
New England.....	Miles 1,069.7	1,000 dollars 143,715	1,000 dollars 21,799	Percent 15.2
Middle Atlantic.....	1,185.2	271,106	18,548	6.8
East North Central.....	2,797.3	250,772	25,690	10.2
West North Central.....	3,754.3	212,148	52,206	24.6
South Atlantic.....	3,029.2	237,901	57,170	24.0
East South Central.....	2,002.0	114,408	33,220	29.0
West South Central.....	3,445.0	206,056	54,351	26.4
Mountain.....	5,709.9	297,364	66,116	22.2
Pacific.....	2,561.6	275,268	36,557	13.3
United States.....	25,554.2	2,008,738	365,657	18.2

Table 7 shows the population, area, national wealth, national income, cash farm income, value of manufactures, and value of mineral production, distributed by geographic divisions. Table 8 shows these same values expressed in terms of the percentage falling in each of the geographic divisions. Columns are included showing the portion of the length and the cost of the interregional system within each geographic division. The distribution is made on the basis of the rural sections, the urban sections, and also on the

TABLE 7.—*Selected economic data by geographic divisions*

Geographic division	Population 1940 ¹	Area 1930 ²	National wealth 1936 ³	National income 1937 ³	Cash farm income 1939 ⁴	Value of manufactures 1937 ⁴	Value of mineral production 1937 ⁴
New England	8,426,566	61,976	22,615,000	5,455,000	246,500	5,109,927	24,757
Middle Atlantic	27,419,893	100,000	87,613,000	19,209,000	672,600	16,596,004	708,951
East North Central	26,550,823	245,564	64,841,000	15,978,000	1,540,000	19,971,022	453,745
West North Central	13,490,492	510,804	29,341,000	6,071,000	1,841,000	4,091,727	417,055
South Atlantic	17,771,099	269,073	27,049,000	6,979,000	789,600	5,403,450	406,084
East South Central	10,762,967	179,509	11,479,000	2,858,000	471,800	1,977,318	220,658
West South Central	13,052,218	429,746	17,363,000	4,569,000	847,200	2,693,027	1,388,412
Mountain	4,128,042	859,009	10,663,000	1,974,000	506,300	928,951	543,091
Pacific	9,682,781	318,095	23,517,000	6,322,000	795,100	3,938,627	510,243
United States	131,409,881	2,973,776	294,481,000	69,419,000	7,711,000	60,710,053	4,672,996

¹ Preliminary figures issued by the United States Bureau of the Census, total includes 125,000 undistributed.² Figures issued by the United States Bureau of the Census.³ National Industrial Conference Board Studies in Enterprise and Social Progress, pp. 62, 117.⁴ Crops and Markets, January 1940.⁵ United States Department of Commerce, report dated Jan. 31, 1940.⁶ Minerals Yearbook, 1939, p. 9.TABLE 8.—*Geographical distribution of the length and estimated cost of the interregional system in relation to various economic indices*

Geographic division	Popula-tion 1940 ¹	Area 1930 ²	Natio-nal wealth 1936 ³	Natio-nal income 1937 ³	Cash farm income 1939 ⁴	Value of manu-fac-tures 1937 ⁴	Value of mineral produc-tion 1937 ⁴	Length of interregional system			Estimated cost of inter-regional system			Estimat-ed cost of improv-ing rural sections of system to "emer-gency" standards
								Rural sec-tions	Urban sec-tions	All sec-tions	Rural sec-tions	Urban sec-tions	All sec-tions	
New England	6.4	2.1	7.7	7.9	3.2	8.4	0.6	4.2	6.0	4.4	7.1	9.6	8.5	5.9
Middle Atlantic	20.9	3.4	29.7	27.7	8.7	27.3	15.2	4.6	10.8	5.4	13.5	22.5	18.2	5.1
East North Central	20.2	8.2	22.0	23.0	20.0	32.9	9.7	11.0	16.6	11.7	12.5	17.7	15.2	7.0
West North Central	10.3	17.2	10.0	8.7	23.9	6.8	8.9	14.7	12.0	14.4	10.6	9.2	9.8	14.3
South Atlantic	13.5	9.0	9.2	10.1	10.2	8.9	8.7	11.9	14.6	12.2	11.8	11.1	11.5	15.6
East South Central	8.2	6.0	3.9	4.1	6.1	3.3	4.7	7.8	8.5	7.9	5.7	6.2	5.9	9.1
West South Central	9.9	14.5	5.9	6.6	11.0	4.4	29.7	13.5	11.6	13.2	10.3	7.3	8.7	14.9
Mountain	3.2	28.9	3.6	2.8	6.6	1.5	11.6	22.3	9.8	20.7	14.8	5.4	9.9	18.1
Pacific	7.4	10.7	8.0	9.1	10.3	6.5	10.9	10.0	10.1	10.1	13.7	11.0	12.3	10.0
United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

¹ Preliminary figures issued by the United States Bureau of the Census.² Figures issued by the United States Bureau of the Census.³ National Industrial Conference Board Studies in Enterprise and Social Progress, pp. 62, 117.⁴ Crops and Markets, January 1940.⁵ United States Department of Commerce, report dated Jan. 31, 1940.⁶ Minerals Yearbook, 1939, p. 9.

basis of the rural and urban sections combined. For purposes of comparing the cost of the work that would be done in each region following the long-range recommended standards with the cost of the work that would be done following the emergency standards, the column on the extreme right has also been added which shows the distribution of the costs of the emergency work.

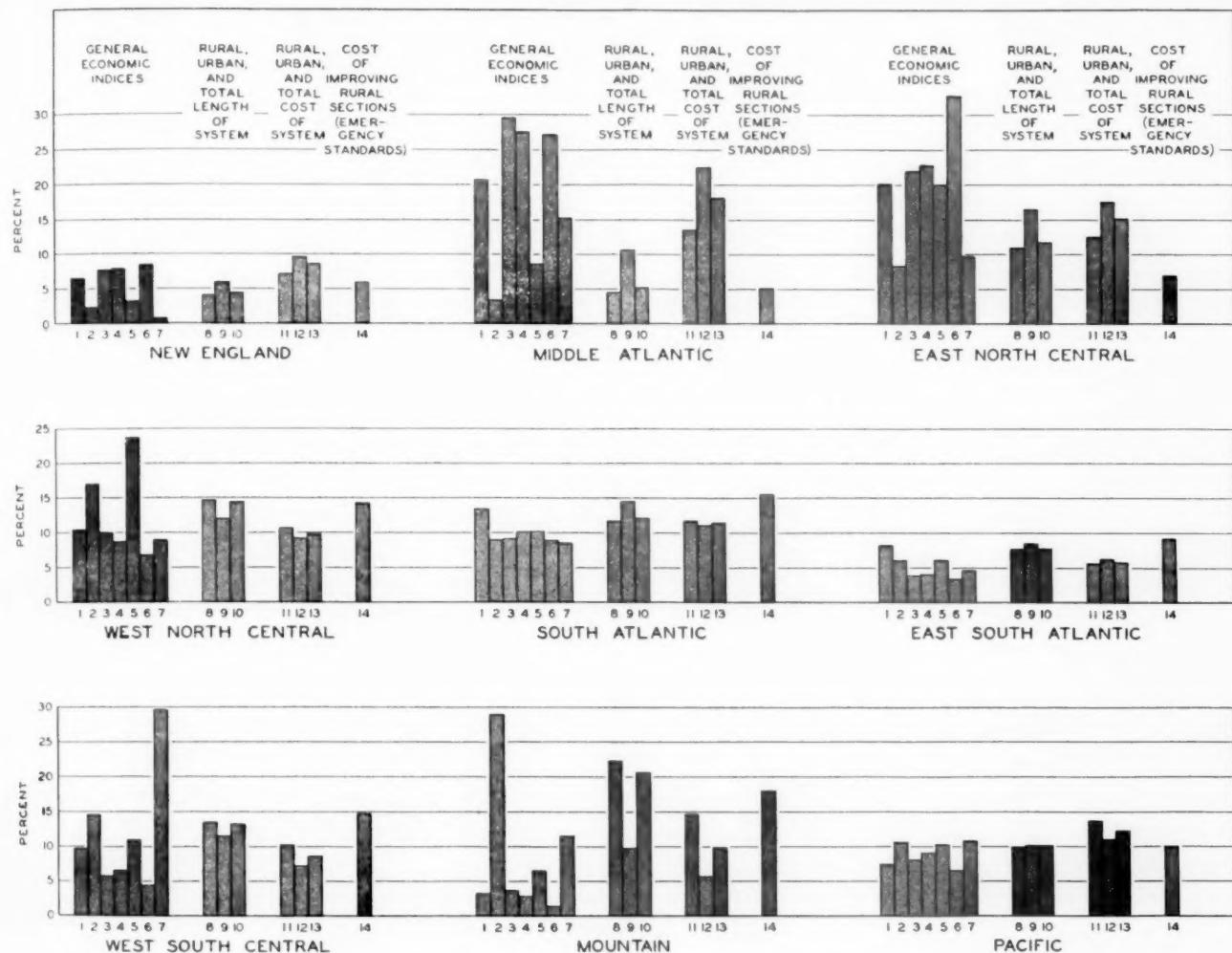
Figure 15 shows this same comparison graphically. To the left of the group of plotted values for each geographic division, the general economic indices are grouped. The value plotted to the extreme left is the percentage of the United States population that falls within the geographic division; next is the percentage of the area; third, the percentage of the national wealth; fourth, the percentage of the national income; fifth, the percentage of the national cash farm income; sixth, the percentage of the national value of manufactures, and finally, the percentage of the national value of mineral production. The next group of plotted values shows the percentage of the length of the interregional system falling within the geographic division. In this group, the value to the left represents the percentage of the length of all rural sections, and the one on the right represents the percentage of the total length including both rural and urban sections, and the mid-section represents the percentage of all urban sections. The third group of plotings shows the percentage of the estimated cost of the interregional system falling within

the geographic division. The value to the left shows the percentage of the cost of all rural sections, and one on the right shows the percentage of the total cost including both rural and urban sections. The single value plotted on the extreme right for each geographic division represents the percentage of the estimated total cost of improvement of rural sections to emergency standards.

It will be noted that the distribution of mileage does not always compare favorably with the various economic indices. However, the distribution of costs of construction to long-range standards in all such cases tends to correct this condition. The level of the plotted values for rural costs alone is usually nearer the level of the economic indices, and the level of the plotted values for total costs is still nearer. The conclusion may be drawn that the system selected on the basis of present traffic service to population concentrations is well distributed on a general economic basis.

The levels of the plotted values representing the percentage distribution of the estimated cost of improvement of rural sections to emergency standards, when compared with the levels of the economic indices, is not so favorable. This is caused by the fact that in working to emergency standards, the same degree of improved service cannot be afforded throughout the country. Only the worst conditions can be remedied.

Table 9 shows the distribution to geographic divisions



ITEM 1 = PERCENTAGE OF POPULATION
 ITEM 2 = PERCENTAGE OF NATIONAL AREA
 ITEM 3 = PERCENTAGE OF NATIONAL WEALTH
 ITEM 4 = PERCENTAGE OF NATIONAL INCOME
 ITEM 5 = PERCENTAGE OF CASH FARM INCOME
 ITEM 6 = PERCENTAGE OF VALUE OF MANUFACTURES
 ITEM 7 = PERCENTAGE OF VALUE OF MINERAL PRODUCTION

ITEM 8 = PERCENTAGE OF INTERREGIONAL SYSTEM RURAL MILEAGE
 ITEM 9 = PERCENTAGE OF INTERREGIONAL SYSTEM URBAN MILEAGE
 ITEM 10 = PERCENTAGE OF INTERREGIONAL SYSTEM TOTAL MILEAGE
 ITEM 11 = PERCENTAGE OF INTERREGIONAL SYSTEM RURAL COSTS
 ITEM 12 = PERCENTAGE OF INTERREGIONAL SYSTEM URBAN COSTS
 ITEM 13 = PERCENTAGE OF INTERREGIONAL SYSTEM TOTAL COSTS
 ITEM 14 = PERCENTAGE OF COST OF IMPROVING RURAL SECTIONS O.
 INTERREGIONAL SYSTEM (EMERGENCY STANDARDS)

FIGURE 15.—GEOGRAPHICAL DISTRIBUTION OF THE LENGTH AND ESTIMATED COST OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM IN RELATION TO VARIOUS ECONOMIC INDICES.

TABLE 9.—*Pertinent highway facts and figures by geographic divisions*

Geographic division	Federal-aid apportionments 1941	Mileage of rural highways ¹	Mileage of urban streets and alleys ²	Total mileage of roads, streets and alleys	Motor-vehicle registrations 1939 ³	State highway income 1939 ⁴
New England						
Middle Atlantic	7,134	82,364	14,591	96,955	1,944,510	91,450
East North Central	17,781	187,494	47,802	235,296	5,813,487	187,911
West North Central	25,364	438,311	67,033	505,344	7,078,336	195,464
South Atlantic	25,390	765,604	49,706	815,310	3,862,461	115,000
East South Central	19,754	333,472	33,288	366,760	3,274,027	185,365
West South Central	12,190	238,832	16,758	255,590	1,458,731	94,041
Mountain	18,486	380,273	34,128	414,401	2,800,053	118,104
Pacific	17,253	333,050	14,178	347,228	1,210,838	66,260
United States	11,010	194,967	26,336	221,303	3,565,177	90,469
	154,362	2,954,367	303,820	3,258,187	31,007,620	1,144,064

¹ Figures compiled in January 1941 by Public Roads Administration and based on latest inventory data or estimates furnished by the State-wide Highway Planning Surveys.

² Estimates compiled in January 1941 by Public Roads Administration from fiscal data collected by the State-wide Highway Planning Surveys.

³ Figures include publicly owned, private and commercial motor vehicles. Figures do not include trailers, semitrailers, or motorcycles, nor 2,250 motor vehicles publicly owned and not registered in any State, compiled from reports of State authorities.

⁴ Figures include transactions relating to debt service, operations of special bridge and grade separation authorities, expenditures of local authorities on State highways, and similar transactions.

TABLE 10.—Geographical distribution of the length and estimated cost of the interregional system in relation to various highway factors

Geographic division	Federal-aid apportionments 1941	Mileage of rural highways ¹	Mileage of urban streets and alleys ²	Total mileage of roads, streets, and alleys	Motor-vehicle registrations 1939 ³	State highway income 1939 ⁴	Length of interregional system			Estimated cost of interregional system			Estimated cost of improving rural sections to "emergency" standards
							Rural sections	Urban sections	All sections	Rural sections	Urban sections	All sections	
New England	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Middle Atlantic	4.6	2.8	4.8	3.0	6.3	8.0	4.2	6.0	4.4	7.1	9.6	8.5	5.9
East North Central	11.5	6.3	15.7	7.2	18.7	16.4	4.6	10.8	5.4	13.5	22.5	18.2	5.1
West North Central	16.4	14.8	22.0	15.5	22.8	17.1	11.0	16.6	11.7	12.5	17.7	15.2	7.0
South Atlantic	16.5	25.9	16.4	25.0	12.5	10.1	14.7	12.0	14.4	10.6	9.2	9.8	14.3
East South Central	12.8	11.3	11.0	11.3	10.6	16.2	11.9	14.6	12.2	11.8	11.1	11.5	15.6
West South Central	7.9	8.1	5.5	7.8	4.7	8.2	7.8	8.5	7.9	5.7	6.2	5.9	9.1
Mountain	12.0	12.9	11.2	12.7	9.0	10.3	13.5	11.6	13.2	10.3	7.3	8.7	14.9
Pacific	11.2	11.3	4.7	10.7	3.9	5.8	22.3	9.8	20.7	14.8	5.4	9.9	18.1
United States	7.1	6.6	8.7	6.8	11.5	7.9	10.0	10.1	10.1	13.7	11.0	12.3	10.0
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

¹ Figures compiled in January 1941 by Public Roads Administration and based on latest inventory data or estimates furnished by the State-wide Highway Planning Surveys.

² Estimates compiled in January 1941 by Public Roads Administration from fiscal data collected by the State-wide Highway Planning Surveys.

³ Figures include publicly owned, private, and commercial motor vehicles. Figures do not include trailers, semitrailers, motorcycles, or 2,250 motor vehicles publicly owned and not registered in any State, compiled from reports of State authorities.

⁴ Figures include transactions relating to debt service, operations of special bridge and grade separation authorities, expenditures of local authorities on State highways and similar transactions.

of highway factors. These items include the 1941 Federal-aid apportionments, the total rural highway mileage, the mileage of urban streets and alleys, the total mileage of roads, streets, and alleys, the 1939 motor vehicle registrations, and the State highway departments' income in 1939. In table 10 these items are expressed in terms of the percentage which falls in each geographic division, and are compared with the portions of the length and the cost of the interregional system falling within each division. Figure 16 shows these same relationships graphically.

BOTH FREIGHT AND PASSENGER VEHICLES MAKE EXTENSIVE USE OF SYSTEM

Freight vehicles.—Close estimates of the use of the rural interregional highways by commercial freight vehicles and the tonnage hauled may be obtained for each State from the average daily commercial traffic per mile, the mileage of the system, the average load carried by commercial vehicles, and the percentage of total commercial vehicles that were loaded. All of these data are produced by the highway planning surveys.

Table 11 shows the mileage of rural interregional highways and the average daily ton-mileage of goods carried by commercial vehicles for each region. The commercial vehicle-mileage of loaded vehicles by States multiplied by average carried load is the basis of these estimates.

The relative use of rural interregional highways varies widely between regions of the country. In the Mountain Region average daily ton-miles per mile of highway are 314, as compared with 840 ton-miles per mile for the country as a whole. Vehicle loadings in the Mountain Region are not below average, but the number of commercial vehicles per mile is lower than in any other region.

In the West South Central Region (Arkansas, Louisiana, Oklahoma, and Texas) the average vehicle load is less than in the Mountain Region, but because the average number of commercial vehicles using the highways in the West South Central Region is higher, the average daily ton-miles per mile is larger than in the Mountain Region.

Ton-miles per mile are greatest in the East North Central Region (Ohio, Indiana, Illinois, Michigan, and Wisconsin). In this region the average number of commercial vehicles is high, and the average carried load per vehicle exceeds that in any other region.

TABLE 11.—Estimated average daily ton-miles and ton-miles per mile on the tentative rural interregional system in 1938

Geographic division	Miles	Average daily ton-miles	Daily ton-miles per mile
New England	1,070	1,300,595	1,215
Middle Atlantic	1,185	1,502,850	1,268
East North Central	2,797	4,232,944	1,513
West North Central	3,784	2,534,761	675
South Atlantic	3,029	3,696,614	1,220
East South Central	2,002	1,459,229	728
West South Central	3,445	2,004,491	581
Mountain	5,710	1,794,613	314
Pacific	2,562	2,930,045	1,144
United States	25,554	21,456,142	840

The average daily ton-miles for the country carried by motor vehicles on the tentative rural interregional system totals 21,456,000; on an annual basis the system is estimated to carry 7,831,000,000 ton-miles. Total truck ton-miles of carried load for all rural highways, exclusive of purely local haulage, are estimated at approximately 57 billion in 1939.² Thus, the rural interregional highway system, comprising 25,554 miles or less than 1 percent of the rural highway mileage of the United States, carries approximately 14 percent of the total truck ton-miles of carried load generated upon all rural highways.

Passenger cars.—Estimates of the use of the rural interregional highways by passenger cars are obtained from the highway planning surveys. These data are presented in table 12, together with a compilation of the passenger-car miles per mile.

As in the case of freight vehicles, the use of the tentative rural interregional system by passenger cars varies widely by regions; in fact, the variation between regions is much wider than in the case of freight vehicles. In the South Atlantic Region, for example, freight-

² Estimated from data furnished by the highway planning surveys.

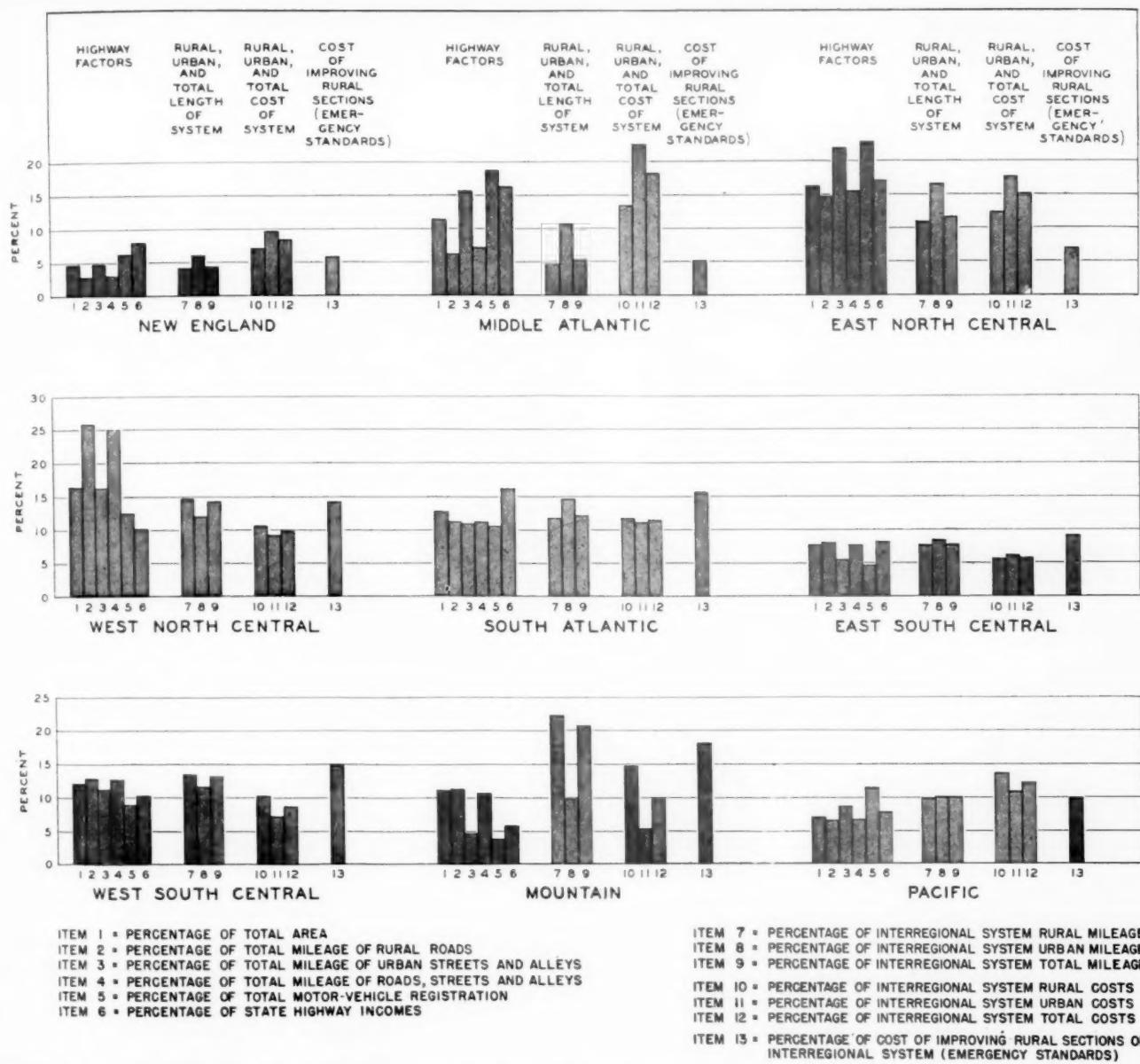


FIGURE 16.—GEOGRAPHICAL DISTRIBUTION OF THE LENGTH AND ESTIMATED COST OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM IN RELATION TO THE GEOGRAPHICAL DISTRIBUTION OF VARIOUS HIGHWAY FACTORS.

vehicle use per mile of the interregional system is 45 percent more than the average for the United States, while passenger-car use per mile in the South Atlantic Region is but 13 percent more than the average for the United States.

Again, in the Middle Atlantic Region the passenger-car use per mile exceeds the average for the Nation by 154 percent, while freight-vehicle use per mile exceeds the average for the Nation by but 51 percent.

Thus, the road use by freight vehicles, although the range is considerable, tends to be much more uniformly distributed by regions than is the case in passenger-car use.

Total passenger-car miles in 1938 for all rural roads in the United States, derived from the road-use surveys, are estimated at 146 billion. Passenger-car use of the interregional system, from table 12, is 14,948 million

passenger-car miles, or approximately 10 percent of passenger-car use of all rural roads of the country.

TABLE 12.—Estimated average daily passenger-car miles and passenger-car miles per mile on the tentative rural interregional highway system in 1938

Geographic division	Miles	Average daily passenger-car miles	Passenger-car miles per mile ¹
New England.....	1,070	3,024,787	2,827
Middle Atlantic.....	1,185	4,833,445	4,079
East North Central.....	2,797	5,655,758	2,022
West North Central.....	3,754	4,594,484	1,224
South Atlantic.....	3,029	5,485,726	1,811
East South Central.....	2,002	2,461,876	1,230
West South Central.....	3,445	4,844,882	1,406
Mountain.....	5,710	4,073,109	713
Pacific.....	2,562	5,979,161	2,334
United States.....	25,554	40,953,228	1,603

¹ Does not include busses. Variation in bus loading and the fact that busses are less than 1 percent of all vehicles make estimates of bus-miles impractical.

TABLE 13.—*Motor-vehicle taxes and other highway-user costs, 1934–39*¹

Year	Net total motor-fuel tax receipts ²	Motor-vehicle registration receipts ³	Motor-carrier tax receipts ⁴	Federal excise taxes paid by highway users ⁵	Bridge and tunnel tolls ⁶	Ferry tolls ⁶	Total ⁷
1934	1,000 dollars 566,642	1,000 dollars 307,260	1,000 dollars 9,402	1,000 dollars 235,743	1,000 dollars 46,693	1,000 dollars 15,151	1,180,891
1935	619,677	322,974	12,421	256,671	49,375	16,021	1,277,139
1936	691,420	359,783	15,137	297,142	53,600	17,392	1,434,474
1937	761,998	390,613	16,216	326,515	57,082	18,522	1,579,946
1938	771,764	388,825	16,421	267,959	57,424	18,633	1,521,026
1939	821,656	412,494	18,055	320,373	60,621	19,670	1,652,899

¹ Compiled by Public Roads Administration.² Figures include distributors' and dealers' licenses, inspection fees, fines and penalties, and other similar miscellaneous receipts.³ Figures include motor-vehicle registration fees, dealers' license plates, operators' and chauffeurs' permits, certificates of title, special titling taxes, fines and penalties, transfers or registration fees, and other similar miscellaneous receipts.⁴ Figures include receipts from gross receipt taxes; mileage, ton-mile and passenger-mile taxes; weight, capacity or flat-rate taxes, certificate or permit fees, caravan taxes, and other similar miscellaneous receipts.⁵ Figures include the estimated portion of taxes on gasoline paid by highway users (90.5 percent), the estimated portion of taxes on lubricating oil paid by highway users (58.0 percent) and the taxes collected on tires, tubes, automobiles, motorcycles, trucks, parts, and accessories.⁶ Figures compiled for year of 1937 and estimates for previous and later years made on the basis of the relative values of gasoline consumption and motor-vehicle registration for these years.⁷ Totals do not include road tolls, municipal or county fees or licenses applicable to motor vehicles, or personal property taxes on motor vehicles. Reliable estimates of these figures were not available.TABLE 14.—*Percentage of motor-vehicle taxes and other highway user costs for 1934 to 1939 from each source*¹

Year	Net total motor-fuel tax receipts ²	Motor-vehicle registration receipts ³	Motor-carrier tax receipts ⁴	Federal excise taxes paid by highway users ⁵	Bridge and tunnel tolls ⁶	Ferry tolls ⁶	Total ⁷
1934	Percent 48.0	Percent 26.0	Percent 0.8	Percent 20.0	Percent 4.0	Percent 1.2	Percent 100.0
1935	48.5	25.3	1.0	20.0	3.9	1.3	100.0
1936	48.2	25.1	1.1	20.7	3.7	1.2	100.0
1937	48.2	25.3	1.0	20.7	3.6	1.2	100.0
1938	50.7	25.6	1.1	17.6	3.8	1.2	100.0
1939	49.7	24.9	1.1	19.4	3.7	1.2	100.0
Average	49.0	25.3	1.0	19.7	3.8	1.2	100.0

¹ Compiled by Public Roads Administration.² Figures include distributors' and dealers' licenses, inspection fees, fines, and penalties, and other similar miscellaneous receipts.³ Figures include motor-vehicle registration fees, dealers' license plates, operators' and chauffeurs' permits, certificates of title, special titling taxes, fines and penalties, transfers or registration fees, and other similar miscellaneous receipts.⁴ Figures include receipts from gross receipt taxes; mileage, ton-mile and passenger-mile taxes; weight, capacity or flat-rate taxes; certificate or permit fees; caravan taxes, and other similar miscellaneous receipts.⁵ Figures include the estimated portion of taxes on gasoline paid by highway users (90.5 percent), the estimated portion of taxes on lubricating oil paid by highway users (58.0 percent) and the taxes collected on tires, tubes, automobiles, motorcycles, truck, parts, and accessories.⁶ Figures compiled for year of 1937 and estimates for previous and later years made on the basis of the relative values of gasoline consumption and motor-vehicle registration for these years.⁷ Totals do not include road tolls, municipal or county fees or licenses applicable to motor vehicles, or personal property taxes on motor vehicles. Reliable estimates of these figures were not available.**MOTOR-VEHICLE TAXES AMOUNT TO 0.582 CENTS PER VEHICLE-MILE**

A highway, like an automobile, earns nothing except when used for transportation service. The more the road is used, the greater are its earnings. These earnings come from various highway-user charges, the more important of which are the motor-fuel taxes, registration fees, and Federal excise taxes. Motor-carrier taxes and tolls comprise a small portion of the cost of operating motor vehicles over the highways. Tables 13 and 14 show these data for the years 1934 to 1939, inclusive.

While the data contained in these two tables are useful for the country as a whole, there is no published information showing the earning power of individual roads. Such information must be calculated from various data such as the vehicle-miles of travel on the road, gallons of gasoline consumed, the rate of gasoline taxes, and the relation between gasoline taxes and other motor-vehicle taxes.

The Public Roads Administration has estimated that in 1939 there was a total of 287,747.5 million vehicle-miles of travel by all kinds of motor vehicles, and that the gasoline consumed amounted to 22,685,056,000 gallons, of which motor vehicles utilized 91.40 percent, or 20,735,120,000 gallons. On this basis a motor vehicle traveled on the average 13.88 miles while consuming 1 gallon of gasoline. This mileage figure repre-

sents a weighted average of gasoline consumption by all kinds of motor vehicles used on city streets and on highways.

From table 14 it is shown that the average of the gasoline tax during the 6 years, 1934–39, constituted 49.0 percent of all motor-vehicle taxes for those years. The Public Roads Administration has also calculated that the weighted average State gasoline tax for the country in 1939 was 3.96 cents per gallon. On this basis the total motor-vehicle taxes collected on a motor vehicle while consuming 1 gallon of gasoline amount to 8.08 cents. By dividing the total taxes collected on a motor vehicle while consuming 1 gallon of gasoline by the total distance traveled, the total tax burden on a motor vehicle per mile is obtained. This amounts to 0.582 cent.

Table 15 shows the annual earnings of rural sections of the tentative interregional system grouped in accordance with geographic divisions and 1937 traffic densities, based upon this rate of 0.582 cent per vehicle-mile. A more detailed study of tax rates by regions would make possible some refinement of the regional earnings.

The earnings have been reduced to a per mile basis in order to compare later the annual cost of each section with its earning capacity.

The annual earnings during the lifetime of an im-

TABLE 15.—*Approximate earnings¹ of rural sections of the interregional highway system for the year 1937*

Geographic division	Sections carrying less than 3,000 vehicles per day				Sections carrying more than 3,000 vehicles but less than 10,000 vehicles per day				Sections carrying 10,000 or more vehicles per day				All sections			
	Length	Daily traffic	Annual earnings		Length	Daily traffic	Annual earnings		Length	Daily traffic	Annual earnings		Length	Daily traffic	Annual earnings	
			Total	Per mile			Total	Per mile			Total	Per mile			Total	Per mile
			1,000 vehicle-miles	1,000 dollars	Miles	1,000 vehicle-miles	1,000 dollars	Miles	1,000 vehicle-miles	1,000 dollars	Miles	1,000 vehicle-miles	1,000 dollars	Miles	1,000 vehicle-miles	1,000 dollars
New England.....	662.2	600	1,466	2,210	337.2	2,038	4,329	12,840	70.3	1,103	2,343	33,330	1,069.7	3,831	8,138	7,610
Middle Atlantic.....	383.0	808	1,716	4,480	699.6	3,682	7,822	11,180	102.6	2,560	24,950	1,185.2	5,695	12,068	10,210	
East North Central.....	2,072.8	3,915	8,317	4,010	720.4	3,193	6,783	9,420	4.1	45	96	23,410	2,797.3	7,153	15,198	5,430
West North Central.....	3,516.6	4,761	10,114	2,880	233.4	1,047	2,224	9,530	4.3	53	113	26,280	3,754.3	5,861	12,451	3,320
South Atlantic.....	2,442.3	3,848	8,174	3,350	541.7	2,579	5,479	10,110	45.2	630	1,338	29,600	3,029.2	7,057	14,991	4,950
East South Central.....	1,873.1	2,729	5,797	3,090	128.9	541	1,149	8,910	6.2	66	140	22,580	2,002.0	3,270	6,946	3,470
West South Central.....	3,035.6	4,489	9,536	3,140	403.2	1,667	3,541	8,780	6.2	66	140	22,580	3,445.0	6,222	13,217	3,840
Mountain.....	5,566.9	4,494	9,547	1,710	143.0	600	1,275	8,920	6.2	66	140	22,580	5,709.9	5,094	10,822	1,900
Pacific.....	1,684.8	2,334	4,958	2,940	840.9	4,344	9,228	10,970	35.9	396	841	23,430	2,561.6	7,074	15,027	5,870
United States.....	21,237.3	28,068	59,625	2,810	4,048.3	19,691	41,830	10,330	268.6	3,498	7,431	27,670	25,554.2	51,257	108,886	4,260

¹ The earnings are based on a rate of 0.582 cent per vehicle-mile, which is the estimated rate for the period 1934-39.

provement greatly exceed the present earnings of an existing highway because of diverted traffic, generated traffic, and the normal rate of increase in traffic. The extent of the influence of each of these three factors will vary considerably with the region, the proximity to urban areas, the type of service rendered, etc. Such variations must be ignored in this paper, and general assumptions must be made for the country as a whole. It seems conservative to estimate that at the time an average rural section is improved to rural standards, the increase in traffic resulting from diversion would be approximately 10 percent, and generated traffic would be approximately 5 percent of the existing traffic. During the lifetime of the improvement, assuming an average life of 30 years, the normal rate of increase in traffic should be such that the average traffic during the entire period should be at least 50 percent greater than the traffic using it during the first year the improved facility is in operation. The average traffic during the lifetime of the improvement would, on the basis of these assumptions, be equal to 150 percent times 110 percent times 105 percent of the traffic using the existing highway, or approximately 173 percent.

The design standards to be applied are controlled by the traffic density of the particular section, adjusted to include traffic which will be diverted to the improvement. The improvements on the system are to extend over a period of years, and the distribution of the rural sections among the various traffic-density groups will shift materially by the time reconstruction of all sections has taken place. Some of the sections constructed in later years would still have earnings comparable with improvement costs after the life of some of the first sections had expired. For these reasons, the total earning capacity of the system would have to be estimated on a very complicated basis, requiring many assumptions. However, the total earning capacity of the system need not be known in comparing the costs with the earnings. If it can be shown that there is a favorable ratio of earnings to costs for any section regardless of which traffic density group it may happen to fall in at the time of its improvement, the ratio of earnings to costs for the system would also have to be favorable.

For a section falling within any one of three major traffic density groups, when classified on the basis of its traffic density, adjusted to include diverted traffic, the average annual earnings per mile and per vehicle-mile during the lifetime of the improvement are shown in table 16, it being assumed that the influence of generated traffic and the normal rate of increase combined would be equal to 105 percent times 150 percent or 157 percent. In this same table there is also shown the amount to which these earnings would accumulate during a period of 30 years, which is assumed to be the average life of the improvements. These earnings per mile would, of course, shift to higher or lower levels if the improvement program were carried on in such a manner that the average adjusted initial traffic density of all sections selected for improvement within any density group were allowed to depart from the 1937 determined average traffic density of that group. An increase can hardly be avoided for the lower traffic density group, but, theoretically, the levels for the intermediate and high traffic density groups could be maintained. Difficulties arising from shifts in levels can be avoided by confining appraisals of earnings to a vehicle-mile basis. The vehicle-mile basis also applies just as well to one geographic division as to another, whereas the earnings per mile within any density group for a geographic division and for the 30-year period following improvement cannot be estimated reliably without exhaustive study.

TABLE 16.—*Average earnings of rural¹ sections of the tentative interregional highway system¹*

Initial traffic density adjusted to include traffic which would be attracted by the improvement	Annual earnings for adjusted initial traffic density		Average annual earnings for 30-year period after improvement		Total earnings for 30-year period after improvement	
	Per mile	Per 1,000 vehicle-miles	Per mile	Per 1,000 vehicle-miles	Per mile	Per 1,000 vehicle-miles
Less than 3,000.....	\$2,810	\$5.82	\$4,410	\$5.82	\$132,300	\$5.82
3,000-9,999.....	10,330	5.82	16,220	5.82	486,600	5.82
10,000 and over.....	27,670	5.82	43,440	5.82	1,303,200	5.82

¹ It is assumed that the average traffic density for the 30-year period will be 157 percent of the initial traffic density adjusted to include traffic which would be attracted by the improvement.

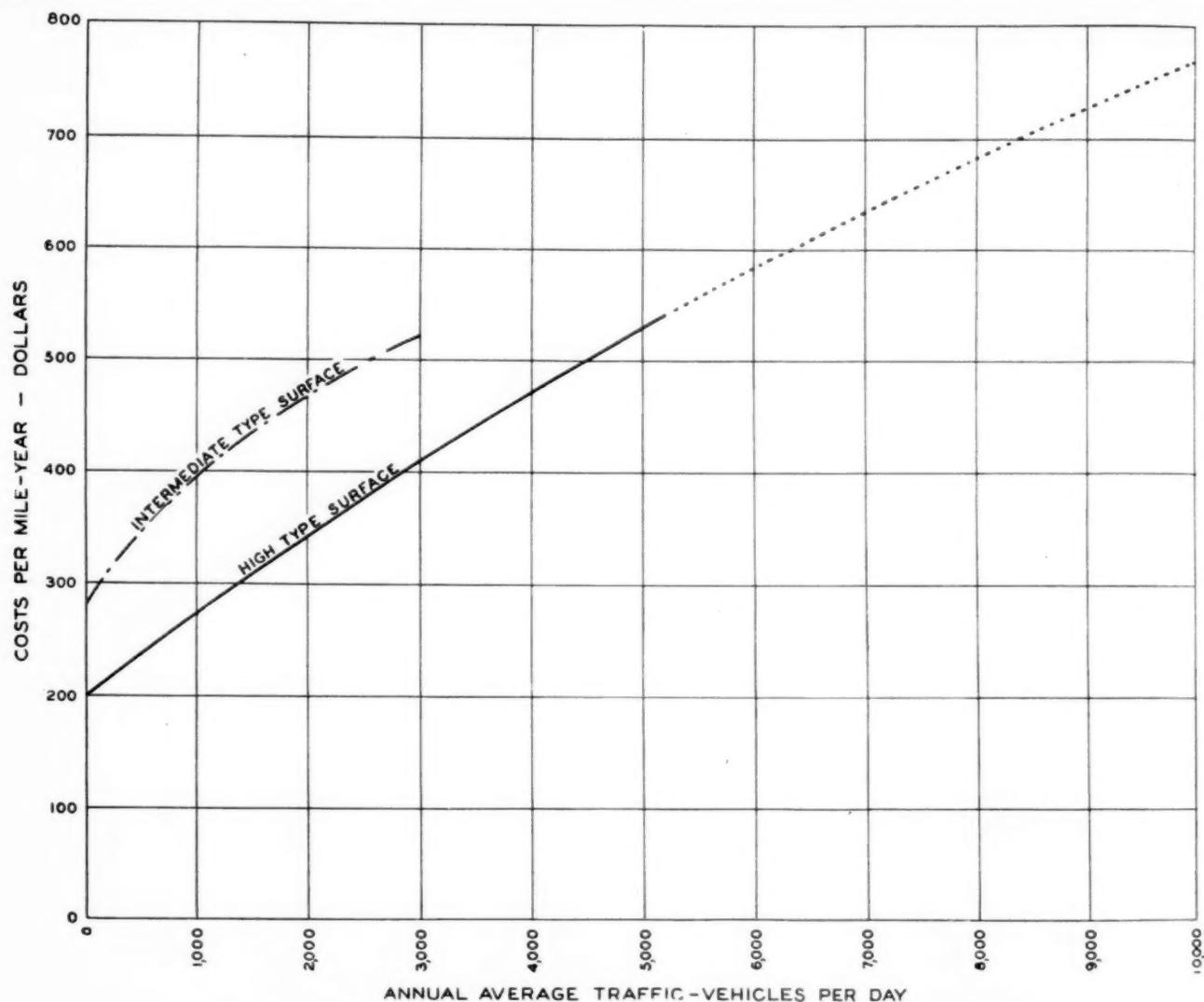


FIGURE 17.—AVERAGE MAINTENANCE COSTS PER MILE FOR VARIOUS TRAFFIC DENSITIES.

IMPROVEMENT, MAINTENANCE, AND OPERATION COSTS DISCUSSED

The estimated cost of improving and operating the system must include suitable allowances for administration, maintenance, operation, and policing, in addition to the cost of the improvements. The cost of improvements actually includes the initial cost, the cost of emergency reconstruction caused by floods, slides, etc., the cost of widening some of the sections where the rate of traffic increase is abnormally high, etc. Allowances for these various classes of construction may be made either in a direct manner or they may be made by considering the average life of the improvements to be a little shorter than the anticipated life of those sections not requiring any reconstruction. The latter basis is preferred, and it is assumed that an average life of 30 years for sections built to the recommended standards is reasonable for the shortened life.

Estimated maintenance costs are based on the unit costs shown in figures 17 and 18. These curves were drawn through the field of points obtained by plotting the maintenance cost data reported in Public Aids to

Transportation, Volume IV.³ The curves for the intermediate-type roads were carried no further than the 3,000 average traffic density ordinate, because it is assumed that any intermediate type surfaces would not be placed on sections carrying more than this number of vehicles. The portion of the curves for the high-type surfaces shown by means of dashed lines was projected for high-traffic densities beyond the range of the plotted points.

The curves should not be considered applicable to 4-lane highways but merely as indicative of the extent to which maintenance costs on 2-lane highways vary with traffic densities up to 5,500 vehicles per day. Beyond this traffic density the dashed curves should be regarded as theoretical projections of the trend in the maintenance costs which might logically be used as a measure of the rate of change in maintenance costs on 4-lane divided highways. The 4-lane highway maintenance costs would obviously be at some higher level. Considering the fact that most of the heavier traveled sections requiring 4-lane treatment will be located where more than usual attention must be paid

³ Published by Section of Research, Federal Coordinator of Transportation, 1940.

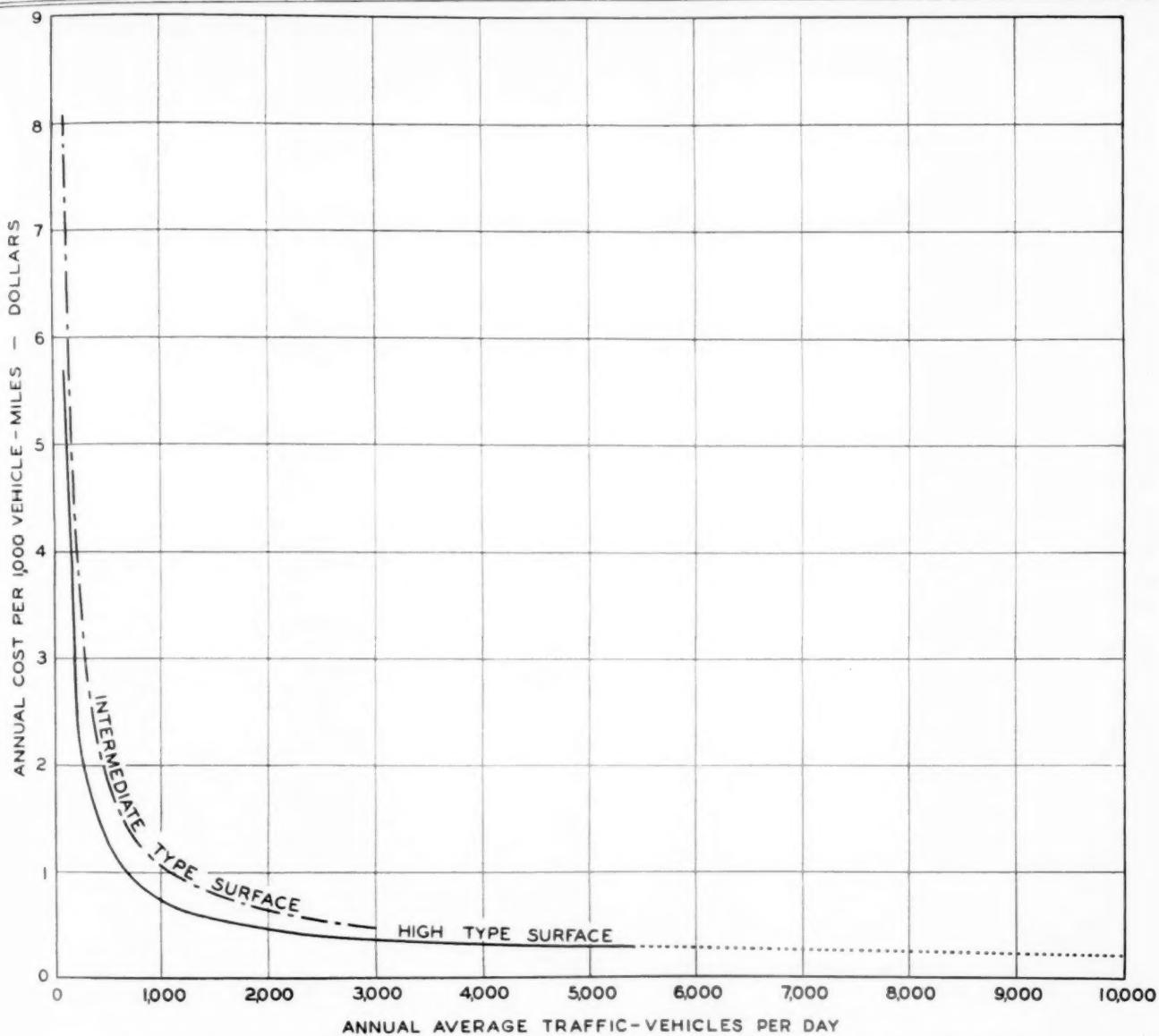


FIGURE 18.—AVERAGE MAINTENANCE COSTS PER VEHICLE-MILE FOR VARIOUS TRAFFIC DENSITIES.

to landscaping, it has been assumed that the amounts indicated by the curves based on 2-lane maintenance costs should be doubled. For highway sections carrying more than 10,000 vehicles per day where special design is recommended, amounts equal to two and one-half times those indicated by curves based on 2-lane maintenance costs have been assumed.

In selecting from the curves a value that is applicable for the life of an improvement, it is necessary to select the value corresponding with the average traffic density during the period of service and not the value for the traffic density at the time of the improvement. In accordance with assumptions made in the calculation of the earning power of the system, the traffic density controlling the selection of the maintenance cost should be 157 percent of the initial traffic density adjusted to include divertable traffic. For values selected for traffic densities of less than 3,000, a point lying somewhere between the two curves should be selected.

Table 17 shows the estimated maintenance and opera-

tion cost during the life of the improvement based upon values obtained from the curves shown in figures 17 and 18. An allowance for policing equal to 15 percent of the maintenance and operation cost is made and an allowance of 5 percent of the total construction and maintenance expenditures is made for administration and overhead.

For a section falling within any one of three major traffic density groups, when classified on the basis of its traffic density adjusted to include diverted traffic, the cost per 1,000 vehicle-miles and the average annual and total costs per mile during the lifetime of the improvement are shown in table 18. As in the case of the earnings similarly shown in a previous table, the costs per vehicle-mile would shift to higher or lower levels if the improvement program were carried on in such a manner that the average initial traffic density of all sections selected for improvement within any density group were to depart from the 1937 determined average traffic density of that group. However, in contrast to the tendency for the earnings per mile to increase, a

decrease can hardly be avoided in the costs per vehicle-mile for the lower traffic density groups, but it would be possible to maintain the levels in the other groups. The effect of any probable change of levels will always be to improve the relationship between earnings and costs, as can be shown by comparison of the estimated earnings and the estimated costs shown in this paper.

TABLE 17.—Average costs of improving and operating rural sections of the tentative interregional system

Initial traffic density adjusted to include traffic which would be attracted by the improvement	Initial cost ¹ of the improvement per 1,000 vehicle-miles of travel during the 30-year period	Maintenance and operation costs, including policing, per 1,000 vehicle-miles of travel during the 30-year period	Administration costs per 1,000 vehicle-miles of travel during the 30-year period	Average annual cost of improvement and operation during the 30-year period		Total cost of improvement and operation during the 30-year period	
				Per mile	Per 1,000 vehicle-miles	Per mile	Per 1,000 vehicle-miles
Less than 3,000	\$2.92	\$0.55	\$0.17	\$2.760	\$3.64	\$82,800	\$3.64
3,000-9,999	2.68	.55	.16	9,460	3.39	283,800	3.39
10,000 and over	2.40	.39	.14	21,900	2.93	657,000	2.93

¹ Includes allowances for right-of-way engineering, and contingencies.

TABLE 18.—Estimated maintenance and operation costs for rural sections of the tentative interregional system¹

Initial traffic density adjusted to include traffic which would be attracted by the improvement	Annual costs for adjusted initial traffic density		Average annual costs during 30-year period after improvement		Total costs during 30-year period after improvement	
	Per mile	Per 1,000 vehicle-miles	Per mile	Per 1,000 vehicle-miles	Per mile	Per 1,000 vehicle-miles
Dollars	Cents	Dollars	Cents	Dollars	Cents	
Less than 3,000	320	66.336	362	47.798	10,860	47.798
3,000-9,999	1,040	58.580	1,330	47.716	39,900	47.716
10,000 and over	2,150	45.227	2,550	34.167	76,500	34.167

¹ It is assumed that the average traffic density for the 30-year period will be 157 percent of the initial traffic density adjusted to include traffic which would be attracted by the improvement.

SUMMARY

Table 19 shows a comparison of the estimated earnings during a 30-year period with the total estimated costs during a 30-year period, which is assumed to be the average life of a section improved to the recommended standards. This is the picture that is obtained when improvements are financed on a "pay as you go" basis, from current revenues, and are undertaken after the present improvement has paid for itself and is due for reconstruction. Obviously, other relationships would exist if new improvements were to be financed by other methods or if new improvements were to be undertaken before the present improvements had served their economic life. If the whole program were to be undertaken at once, financing charges would have to be included in the costs, and earnings required to liquidate the unretired balance of the investments in existing improvements would have to be subtracted from the earnings. These two operations would narrow or possibly wipe out the excess earnings of the system.

Before these excess earnings, shown in table 19, excite too much enthusiasm for the interregional highway system proposal, and before they invite false conclusions as to the advisability of proceeding immediately with a great portion of the work financed by

borrowed money, careful consideration must be given to their true meaning.

TABLE 19.—Comparison of costs and earnings of rural sections of the tentative interregional system

Initial traffic density adjusted to include traffic which would be attracted by the improvement	Total cost of improvement and operation during the 30-year period		Total earnings during the 30-year period		Excess of earnings over costs during the 30-year period		Ratio of costs to earnings during the 30-year period
	Per mile	Per 1,000 vehicle miles	Per mile	Per 1,000 vehicle miles	Per mile	Per 1,000 vehicle miles	
Less than 3,000	\$82,800	\$3.64	\$132,300	\$5.89	\$49,500	\$2.25	63
3,000-9,999	283,800	3.39	486,600	5.89	202,800	2.50	58
10,000 and over	657,000	2.93	1,303,200	5.89	646,200	2.96	50

Present practice does not consist of financing highways of a single class with funds earned by that class. If costs and earnings were balanced for each class of highways, lightly traveled routes could seldom be improved with available funds to the minimum standard satisfactory to the highway users. The construction of lightly traveled secondary and local roads must be subsidized from excess earnings of heavily traveled routes. Unless this practice were followed, lightly traveled routes could not be developed unless additional funds from a new source were made available. Unless lightly traveled or feeder routes, which provide access to widely scattered points, were developed, the main highways would be less heavily traveled and the earning capacity of the main traveled routes would be reduced.

The interregional highway system tentatively selected is the most heavily traveled integrated national system that it has been possible to select. The routes in each State are invariably the greatest, or at least among the greatest, revenue producing routes. It would seem that even a lower percentage of their total earnings should be applied to the development and operation of the system than is applied to the remaining heavily traveled routes of the State highway systems, if equilibrium is to be maintained amongst the various systems.

It is interesting to note that even within the interregional system, table 19 shows that the total earnings during the 30-year period following improvement would exceed the total costs during the 30-year period by greater amounts for the more heavily traveled sections than for the more lightly traveled sections. The percentage of the earnings required for expenses over a 30-year period on sections having adjusted initial traffic densities of less than 3,000 vehicles is shown to be 63 percent. For sections falling within the intermediate traffic density group where 4-lane highway design is recommended, the percentage of the earnings required for expenses drops to 58; and for sections falling within the highest traffic density group, the percentage drops to 50.

These relationships are only preliminary indications. The main problem still lies ahead in refining the analysis by substituting facts and field determinations for present assumptions and estimates. The present analysis must be extended to include various methods of financing and complete studies must be made by regions and by States. Coincident with these studies, studies must be made of the amount that local roads must be subsidized from excess earnings of the more heavily traveled systems. In fact, analyses similar to this interregional

system analysis must be applied to all systems. Standards for all systems must be adjusted to levels that can be afforded. These refinements and extensions of the analysis of the rural sections will require a great deal of work, but the larger and more significant job ahead is planning the improvement of urban sections.

The best preliminary estimate shows that the cost of urban sections of the tentative interregional system is only about one-fifth of the expenditure that must be made to modernize highway and street facilities in the cities traversed. The modernization of only the interregional system in the vicinity of cities would be but a palliative because the system would soon be overloaded by traffic attracted to its superior facilities. Only by construction of comparable facilities in other directions on the cities' street networks can the economic growth of cities and the success of the interregional system itself be assured.

APPENDIX

In the discussion of design standards it was stated that:

The limiting degree of horizontal curvature must usually be selected on the basis of a number of economic considerations, only one of which is the extent to which desirable sight distances can be provided. Once the specifications for horizontal alignment and cross sections are settled, the sight distances limited by cut banks on horizontal curves are fixed. Obviously, no advantage to the traveling public can be gained by increasing lengths of vertical curves occurring on horizontal curves beyond those lengths required to provide sight distance equal to that afforded by the horizontal curve. There is, therefore, no justification for construction expenditures for this purpose.

On horizontal curves having sufficient length for the view between vehicles on the curve to be restricted by the cut bank, there is a constant, for any distance between the centerline of the highway and the cut bank, which, when divided by the degree of curvature may be multiplied by the algebraic difference in grades to give the length of vertical curve whose crest will limit sight distance to the same extent as the cut bank will limit it. Such a constant is specified for the interregional system and its value for the interregional highway cross section is 700.

For sections of the highway located on tangent, and on short horizontal curves where sight distance is not restricted by cut banks but by crests in vertical alignment, constants shown in table A are specified. These constants, when multiplied by the algebraic difference in grades, give lengths of vertical curves which will provide sight distances as great as can be afforded and yet maintain equilibrium between this feature of design and the other features. It will be noted that shorter vertical curves, and correspondingly shorter sight distances, are specified for 4-lane divided highways than are specified for 2-lane highways. This is done because the chief advantage in increasing the sight distance on 4-lane divided highways is that safe stopping distances for higher speeds of travel are provided; but on 2-lane highways, the further advantage is gained that vehicles traveling in the same direction may pass one another at higher speeds without increasing the hazard of meeting an oncoming car before completing the passing maneuver. This hazard obviously does not exist on 4-lane divided highways.

For the various classifications of 4-lane highway sections, the speeds for which adequate sight distances on vertical curves are provided are related to the speeds

at which horizontal curves of the maximum degree may be negotiated safely, because the economic limits of both the degree of horizontal curvature and the length of vertical curve for various classification of highways are determined by the type of topography and the traffic service. Also, in terrain where drivers are required to reduce their speeds in order to negotiate the horizontal curves, relatively short vertical curves should not be found as objectionable as they are in flatter terrain. Careful consideration of the rate that excavation quantities increase with lengths of vertical curves has led to the conclusion that the greatest speed for which sight distances on crests in vertical alignment can be made equal to safe stopping distances, without excessive expenditures, is the maximum speed that can be traveled around horizontal curves of one-half the maximum degree (twice the minimum radius) specified for the particular classification of the highway section. This criterion has been selected because (1) most of the horizontal curves occurring on any section have shorter radii than the radius of a curve of half the maximum specified degree, which means that drivers of vehicles will generally be accustomed to reducing speeds below this critical speed on most of the horizontal curves, and (2) an examination of resulting speeds indicates that they are reasonable in relation to other factors.

TABLE A.—Values of K^1 for computing length of vertical curves on horizontal tangents and short horizontal curves²

Classification of section	Present average daily traffic density	Type of topography	Values of K	
			Minimum permissible	Maximum desirable
I	Less than 1,000	Relatively level	1,070	1,070
		Rolling	550	550
		Mountainous	260	260
II	1,000-1,999	Relatively level	1,070	1,070
		Rolling	550	550
		Mountainous	260	260
III	2,000-2,999	Relatively level	1,070	1,070
		Rolling	550	550
		Mountainous	260	260
IV	3,000-4,999	Relatively level	465	465
		Rolling	233	465
		Mountainous	175	465
V	5,000-9,999	Relatively level	465	465
		Rolling	350	465
		Mountainous	280	465
VI	10,000 or more	Relatively level	465	465
		Rolling	350	465
		Mountainous	280	465

¹ Length of vertical curve = algebraic difference of grades $\times K$. For use only where sight distance is restricted by vertical curve.

² For computing lengths of vertical curves occurring on long horizontal curves where sight distance is restricted by cut bank, use formula $K = 700$ in all traffic

$\frac{D}{D}$ classifications and on all horizontal curves whose lengths are in excess of the following values:

	Feet	Feet
1° curve	1,090	440
2° curve	750	410
3° curve	620	380
4° curve	530	370
5° curve	480	350

Maximum lengths of vertical curves in relatively level topography shall be 4,000 feet, in rolling topography 3,000 feet, and in mountainous topography 2,000 feet.

Values of the constants for computing lengths of vertical curves occurring at crests on 2-lane highways are based on providing sight distances permitting passing maneuvers (1) in relatively level topography when the passing and oncoming vehicles travel 60 miles per hour and the passed vehicle travels 50 miles per hour, (2) in rolling topography when the passing and oncoming vehicles travel 50 miles per hour and the passed vehicle travels 40 miles per hour, (3) in mountainous topography when the passing and oncoming vehicles travel 40 miles per hour and the passed vehicle travels 30 miles per hour. Actually, passings can probably take

place safely at higher speeds than these because the calculations are based on existing passing maneuver theory which appears to be on the conservative side. In cases where maximum algebraic differences in grades are approached, the standards specify reduced lengths of vertical curves below the values obtained by the use of the constants. These reduced lengths are necessary

because of topographical difficulties and should be accepted even though the speeds at which passing maneuvers may take place are lowered by about 10 percent.

The maximum safe speeds of travel at any point where the sight distance is limited by any feature of the design are shown in table B.

TABLE B.—Maximum safe speeds permitted by limiting vertical curves¹ suggested for interregional highways

Classification of section	Present average daily traffic density	Type of topography	Speeds permitted on vertical curves occurring on long horizontal curves when sight distance is restricted by cut bank				Speeds permitted on vertical curves occurring on horizontal tangents or short horizontal curves			
			Minimum permissible length of vertical curve		Minimum desirable length of vertical curve		Minimum permissible length of vertical curve		Minimum desirable length of vertical curve	
			Lowest maximum safe speed ²	Lowest maximum passing speed ³	Lowest maximum safe speed ²	Lowest maximum passing speed ³	Lowest maximum safe speed ²	Lowest maximum passing speed ³	Lowest maximum safe speed ²	Lowest maximum passing speed ³
I	Less than 1,000	Relatively level	M. p. h.	M. p. h.	M. p. h.	M. p. h.	M. p. h.	M. p. h.	M. p. h.	M. p. h.
		Rolling	68	28	68	28	80+	53-60	80+	53-60
		Mountainous	53	20	68	28	76-80+	44-50	80+	50
II	1,000-1,999	Relatively level	68	28	68	28	76-80+	53-60	80+	53-60
		Rolling	53	20	68	28	61-70	44-50	80+	50
		Mountainous	47	17	68	28	61-70	35-40	80+	40
III	2,000-2,999	Relatively level	68	28	68	28	80+	53-60	80+	53-60
		Rolling	56	20	68	28	79-80+	44-50	80+	50
		Mountainous	52	18	68	28	64-70	35-40	80+	40
IV	3,000-4,099	Relatively level	68	68	68	68	80+	80+	80+	80+
		Rolling	56	56	68	68	70	70	80+	80+
		Mountainous	52	52	68	68	64	64	80+	80+
V	5,000-9,999	Relatively level	68	68	68	68	80+	80+	80+	80+
		Rolling	63	63	68	68	78	78	80+	80+
		Mountainous	59	59	68	68	73	73	80+	80+
VI	10,000 or more	Relatively level	68	68	68	68	80+	80+	80+	80+
		Rolling	63	63	68	68	78	78	80+	80+
		Mountainous	59	59	68	68	73	73	80+	80+

¹ When sight distance is restricted by cut banks on horizontal curves, vertical curves have been selected which provide the same sight distances as do the horizontal curves. Therefore, lengthening of vertical curves would not make higher safe speeds possible.

² Lowest maximum safe speed is the maximum speed which vehicles can travel and yet stop safely within the sight distance provided on the shortest vertical curve permitted for the indicated classification of highway.

³ Lowest maximum passing speed is the maximum speed which passing and oncoming vehicles may travel and yet complete a passing maneuver when the passed vehicle is traveling 10 miles per hour slower on the shortest vertical curve permitted for the indicated classification of highway.

⁴ The lower speed applies when the algebraic difference in grades is the maximum permitted; the higher speed applies when the algebraic difference in grades is less than two-thirds of the maximum allowable.

MOTOR-FUEL CONSUMPTION-1940

COMPILED FOR CALENDAR YEAR FROM REPORTS OF STATE AUTHORITIES 1/

TABLE G-2, 1940
ISSUED MAY 1941

STATE	TAX RATE PER GALLON ON DECEMBER 31	GROSS AMOUNT REPORTED 2/	AMOUNT EXEMPTED FROM PAYMENT OF TAX 3/	GROSS AMOUNT ASSESSED FOR TAXATION	AMOUNT SUBJECT TO REFUND OF ENTIRE TAX	NET AMOUNT TAXED			AMOUNT TAXED AT PREVAILING RATE DURING 1939	INCREASE DURING 1940		STATE	
						TOTAL	AT PREVAILING RATE	AT OTHER RATES		AMOUNT	PER-CENT-AGE		
ALABAMA	6	259,915	-	259,915	-	259,915	259,915	-	241,375	18,540	7.7	ALABAMA	
ARIZONA	5	113,435	4,575	108,860	13,153	95,707	95,707	-	69,939	5,768	6.4	ARIZONA	
ARKANSAS	6.5	191,421	7,620	183,801	-	183,801	162,328	(4/)	155,709	6,619	4.3	ARKANSAS	
CALIFORNIA	3	1,948,880	37,190	1,911,682	153,356	1,758,326	-	-	1,673,786	88,546	5.1	CALIFORNIA	
COLORADO	4	251,877	8,645	243,232	36,490	206,742	206,742	-	190,167	10,595	5.4	COLORADO	
CONNECTICUT	3	380,375	7,567	372,808	8,214	364,594	364,594	-	335,146	29,448	8.8	CONNECTICUT	
DELAWARE	4	63,920	1,498	62,422	4,025	58,397	58,397	-	54,410	3,987	7.2	DELAWARE	
FLORIDA	7	408,124	19,407	389,717	-	388,717	388,717	-	350,282	-	11.0	FLORIDA	
GEORGIA	6	400,296	13,449	386,847	-	386,847	386,847	-	352,862	31,985	9.6	GEORGIA	
IDAHO	5.5	107,644	3,677	103,967	-	103,967	94,565	(5/)	68,444	6,121	6.9	IDAHO	
ILLINOIS	3	1,580,441	-	1,580,441	129,474	1,410,967	1,410,967	-	1,336,233	74,736	5.6	ILLINOIS	
INDIANA	4	700,360	2,263	688,097	56,933	641,164	-	-	598,734	42,430	7.1	INDIANA	
IOWA	3	572,720	-	572,720	86,725	485,995	485,995	-	469,102	16,893	3.6	IOWA	
KANSAS	3	503,586	156,866	346,720	205,305	346,720	346,720	-	334,577	2,143	3.6	KANSAS	
KENTUCKY	5	305,334	10,129	295,205	-	295,205	295,205	-	275,107	20,094	7.3	KENTUCKY	
LOUISIANA	7	278,083	5,855	272,234	4	272,234	272,234	2	247,419	16,639	6.7	LOUISIANA	
MAINE	4	157,361	957	156,414	-	156,414	149,130	1	87,274	141,850	5.1	MAINE	
MARYLAND	4	314,606	4,854	309,752	20,107	289,645	286,645	3	21,088	7,920	7.9	MARYLAND	
MASSACHUSETTS	3	747,204	2,941	744,263	30,905	713,358	713,358	-	683,733	29,625	10.4	MASSACHUSETTS	
MICHIGAN	3	1,253,535	116,333	1,137,202	51,819	1,082,383	1,082,383	1,0	994,058	87,948	8.8	MICHIGAN	
MINNESOTA	11/ 3	593,842	29,563	564,279	66,623	497,556	497,556	-	469,578	27,978	6.0	MINNESOTA	
MISSISSIPPI	6	214,538	9,171	205,367	-	205,367	197,570	1	188,424	4,494	2.2	MISSISSIPPI	
MISSOURI	2	697,585	-	697,585	39,224	658,321	658,321	-	620,791	37,530	6.0	MISSOURI	
ONTARIO	5	137,639	7,061	130,578	26,127	104,451	104,451	-	98,919	5,532	5.5	ONTARIO	
NEBRASKA	5	244,354	10,697	233,657	8	233,653	233,653	1	212,215	1,319	6.5	NEBRASKA	
NEVADA	4	42,788	2,663	40,125	2,602	37,523	37,523	5	33,618	6,212	6.2	NEVADA	
NEW HAMPSHIRE	4	95,827	653	95,174	4,352	90,822	90,822	-	88,448	2,374	2.7	NEW HAMPSHIRE	
NEW JERSEY	2	895,684	2,978	895,706	73,280	822,426	822,426	-	773,346	47,080	6.3	NEW JERSEY	
NEW MEXICO	5	110,917	5,569	105,348	11,152	94,196	94,196	-	86,374	7,822	9.1	NEW MEXICO	
NEW YORK	4	1,970,555	76,621	1,893,924	56,957	1,836,977	1,836,977	-	1,768,288	3,084	2.0	NEW YORK	
NORTH CAROLINA	6	463,406	9,788	453,712	=	453,712	440,548	1	410,340	30,208	7.4	NORTH CAROLINA	
NORTH DAKOTA	4	157,246	61,446	95,780	-	85,780	85,780	-	152,824	3,084	3.7	NORTH DAKOTA	
OHIO 16/	4	1,473,956	73,096	1,400,768	12,958	1,387,804	1,387,804	1	86,919	1,231,223	7.3	OHIO 16/	
OKLAHOMA	4	481,161	62,310	378,865	570	376,275	376,275	5	1,205,725	12,540	3.4	OKLAHOMA	
OREGON	5	264,672	5,017	259,655	29,816	229,899	229,899	1	212,603	15,787	7.4	OREGON	
PENNSYLVANIA	5	1,581,975	6,897	1,575,078	-	1,575,078	1,575,078	-	1,476,077	99,001	6.7	PENNSYLVANIA	
RHODE ISLAND	3	133,903	1,271	130,692	1,134	131,558	131,558	-	126,095	4,663	3.6	RHODE ISLAND	
SOUTH CAROLINA	6	242,207	234,207	4,909	229,398	229,398	229,398	-	206,953	29,445	10.8	SOUTH CAROLINA	
SOUTH DAKOTA	4	185,713	1,821	182,877	29,218	113,659	113,659	-	103,987	9,672	9.3	SOUTH DAKOTA	
TEXAS	4	1,414,932	16,024	1,399,908	201,214	1,195,694	1,195,694	-	1,140,442	55,252	4.8	TEXAS	
UTAH	4	107,194	4,709	102,425	-	102,425	102,425	-	94,349	5,076	5.6	UTAH	
VERMONT	4	70,806	880	69,926	-	69,926	69,926	-	67,137	2,789	4.2	VERMONT	
VIRGINIA	5	417,599	-	417,599	24,669	392,930	392,930	3	358,541	31,845	9.4	VIRGINIA	
WASHINGTON	5	386,348	10,776	375,572	27,700	347,872	347,872	-	320,941	26,931	8.4	WASHINGTON	
WEST VIRGINIA	5	221,005	-	221,005	6,022	214,983	214,983	-	180,640	13,343	6.0	WEST VIRGINIA	
WISCONSIN	4	569,679	17,670	572,719	42,380	529,733	529,733	-	507,776	21,957	4.3	WISCONSIN	
WYOMING	4	70,753	1,754	68,999	-	68,999	68,999	-	65,673	3,326	5.1	WYOMING	
DISTRICT OF COLUMBIA	2	169,512	7,441	162,071	1,117	160,954	160,954	-	142,776	18,178	12.7	DISTRICT OF COLUMBIA	
TOTAL	20/ 3.96	24,167,190	854,008	23,313,182	1,258,151	22,055,031	21,913,441	-	141,590	20,629,979	1,283,462	6.2	TOTAL

1/ AN ANALYSIS OF MOTOR-FUEL USAGE WILL BE GIVEN IN TABLE G-21, TO BE PUBLISHED LATER.

2/ EXPORT SALES AND OTHER AMOUNTS NOT REPRESENTING CONSUMPTION IN STATE HAVE BEEN ELIMINATED AS FAR AS POSSIBLE. IN CASES WHERE STATES FAILED TO REPORT AMOUNTS EXEMPTED FROM TAXATION, THE GROSS AMOUNT TAXED IS SHOWN IN THIS COLUMN.

3/ INCLUDES ALLOWANCES FOR EVAPORATION AND OTHER LOSSES, FEDERAL USE, OTHER PUBLIC USE, AND NONHIGHWAY USE, WHERE INITIAL EXEMPTIONS RATHER THAN REFUNDS ARE MADE.

4/ WITHIN 300 FEET OF BORDER, TAX IS REDUCED TO THAT OF ADJACENT STATE. GALLONS TAKEN AT 5¢, 2,500,000; 5¢, 4 CENTS, 16,107,000.

5/ AVIATION FUEL TAXED AT 2.5 CENTS, 369,000 GALLONS; MOTOR FUEL TAXED AT 0.1 CENT (5 CENTS REFUNDED ON NONHIGHWAY USE), 9,053,000 GALLONS.

6/ GALLONS TAKEN AT 5 CENTS, 16,107,000 GALLONS AT 4 CENTS, 85,641,000.

7/ REPRESENTS EVAPORATION OR LOSS ALLOWANCE UNDER 5-CENT TAX NOT ALLOWED UNDER ADDITIONAL 2-CENT TAX, WHICH IS ADMINISTERED UNDER A SEPARATE LAW.

8/ THREE CENTS PER GALLON REFUNDED ON NONHIGHWAY USES.

9/ ONE CENT PER GALLON REFUNDED ON MOTOR FUEL USED IN VEHICLES LICENSED TO OPERATE

EXCLUSIVELY IN CITIES.

10/ ONE AND ONE-HALF CENTS PER GALLON REFUNDED ON MOTOR FUEL USED IN INTERSTATE AVIATION.

11/ RATE CHANGED FROM 4 CENTS TO 3 CENTS SEPTEMBER 1.

12/ FIVE CENTS PER GALLON REFUNDED ON NONHIGHWAY USES.

13/ AVIATION FUEL USED IN FLYING INSTRUCTION.

14/ DIESEL FUEL, 1,749,000 GALLONS; AND BUTANE, 57,000 GALLONS.

15/ GALLONS TAXED AT 3 CENTS, 35,693,000; AT 4 CENTS, 47,007,000.

16/ AMOUNTS GIVEN DO NOT INCLUDE 65,204,000 GALLONS OF LIQUID FUEL (KEROSENE, FUEL OIL, ETC.) TAXED AT 1 CENT PER GALLON BUT NOT SUBJECT TO THE 3-CENT TAX ON MOTOR VEHICLE FUEL.

17/ FOUR CENTS PER GALLON REFUNDED ON MOTOR FUEL USED IN AVIATION.

18/ REVISED SINCE PUBLICATION OF TABLE G-2, 1939.

19/ TWO CENTS PER GALLON REFUNDED ON MOTOR FUEL USED IN INTRASTATE AVIATION.

20/ WEIGHTED AVERAGE RATE.

STATE MOTOR-FUEL TAX RECEIPTS - 1940

COMPILED FOR CALENDAR YEAR FROM REPORTS OF STATE AUTHORITIES

TABLE C-1, 1940
ISSUED MAY 1941

STATE	TAX RATE PER GALLON ON DECEMBER 31	RECEIPTS FROM TAXATION OF MOTOR FUEL					OTHER RECEIPTS IN CONNECTION WITH MOTOR-FUEL TAX ^{2/}					NET TOTAL RECEIPTS	LESS TAX ON AVIATION GASOLINE	ADJUSTED NET TOTAL RECEIPTS	STATE	
		GROSS TAX COLLEC-	DEDUC- TIONS BY DISTRIB- UTORS FOR EXPENSES ^{1/}	GROSS RECEIPTS BY STATE	REFUNDS PAID	NET RECEIPTS BY STATE	DISTRIB- UTORS AND DEALERS LICENSES	INSPEC- TION FEES ^{2/}	FINES AND PENAL- TIES	MISCELLANEOUS RECEIPTS	TOTAL					
ALABAMA	6	15,470	-	15,470	-	15,470	-	65	-	-	65	15,535	-	15,535	ALABAMA	
ARIZONA	5	5,556	-	5,556	789	4,767	*	2	-	-	2	4,769	-	4,769	ARIZONA	
ARKANSAS	6.5	11,312	-	11,312	-	11,312	-	100	*	-	100	11,412	-	11,412	ARKANSAS	
CALIFORNIA	3	56,561	-	56,601	4,601	51,960	17	-	-	1	18	51,978	-	51,978	CALIFORNIA	
COLORADO	4	9,632	-	9,632	1,381	8,291	-	-	-	-	-	8,291	-	8,291	COLORADO	
CONNECTICUT	3	11,392	114	11,278	246	11,032	51	-	1	-	52	11,084	-	11,084	CONNECTICUT	
DELAWARE	4	2,483	-	2,483	161	2,322	3	-	-	-	3	2,325	-	2,325	DELAWARE	
FLORIDA	7	26,929	-	26,929	-	26,929	39	480	-	-	519	27,448	-	27,448	FLORIDA	
GEORGIA	6	23,039	230	22,809	-	22,809	32	-	-	-	32	22,841	-	22,841	GEORGIA	
IDAHO	5.1	5,281	-	5,281	459	4,822	1	-	-	-	2	3	4,825	8	4,817	IDAHO
ILLINOIS	3	46,191	924	45,267	3,907	41,360	-	163	1	-	464	41,824	-	41,824	ILLINOIS	
INDIANA	4	27,787	-	27,787	2,293	25,494	*	573	-	1	574	26,068	-	26,068	INDIANA	
IOWA	3	17,190	-	17,190	2,598	14,592	63	-	-	-	63	14,655	-	14,655	IOWA	
KANSAS	3	10,402	-	10,402	-	10,402	15	110	-	35	160	10,562	-	10,562	KANSAS	
KENTUCKY	5	14,861	148	14,713	-	14,713	-	-	4	-	4	14,717	-	14,717	KENTUCKY	
LOUISIANA	7	18,584	-	18,584	-	18,584	-	87	*	-	87	18,671	-	18,671	LOUISIANA	
MAINE	4	6,158	-	6,158	218	5,940	-	-	*	-	*	5,940	11	5,929	MAINE	
MARYLAND	4	12,282	-	12,282	834	11,448	-	-	-	-	-	11,448	-	11,448	MARYLAND	
MASSACHUSETTS	2	22,328	-	22,328	927	21,401	53	-	*	-	53	21,454	-	21,454	MASSACHUSETTS	
MICHIGAN	3	34,116	-	34,116	1,650	32,466	5	-	8	-	13	32,479	81	32,398	MICHIGAN	
MINNESOTA	3/	20,933	-	20,933	2,588	18,345	1	174	1	5	181	18,526	-	18,526	MINNESOTA	
MISSISSIPPI ^{5/}	6	12,337	-	12,337	406	11,931	-	-	-	-	-	11,931	-	11,931	MISSISSIPPI ^{5/}	
MISSOURI	2	13,893	-	13,893	592	13,301	-	143	11	-	158	13,455	-	13,455	MISSOURI	
MONTANA	5	6,378	-	6,378	1,310	5,068	-	6	-	-	6	5,074	-	5,074	MONTANA	
NEBRASKA	5	12,133	91	12,042	300	11,742	10	120	-	29	159	11,901	73	11,828	NEBRASKA	
NEVADA	4	1,620	31	1,589	104	1,485	*	21	1	-	22	1,507	-	1,507	NEVADA	
NEW HAMPSHIRE	4	3,790	-	3,790	178	3,616	-	-	-	-	1	3,617	-	3,617	NEW HAMPSHIRE	
NEW JERSEY	3	26,566	-	26,566	2,320	24,226	93	-	1	17	111	24,337	-	24,337	NEW JERSEY	
NEW MEXICO	5	5,245	-	5,245	559	4,676	23	-	-	-	23	4,699	-	4,699	NEW MEXICO	
NEW YORK	4	76,062	761	75,301	2,246	73,055	61	-	*	-	61	73,116	-	73,116	NEW YORK	
NORTH CAROLINA	6	26,932	-	26,932	658	26,274	-	1,059	-	9	1,098	27,372	-	27,372	NORTH CAROLINA	
NORTH DAKOTA	4	3,464	52	3,464	61	3,351	*	77	-	24	101	3,452	-	3,452	NORTH DAKOTA	
OHIO	4	53,374	5/	53,374	2,585	50,789	-	-	-	-	-	50,789	-	50,789	OHIO	
OKLAHOMA	4	15,174	379	14,795	21	14,771	-	296	-	-	296	15,067	-	15,067	OKLAHOMA	
OREGON	5	12,931	-	12,931	1,572	11,359	-	-	*	-	11	11,359	14	11,345	OREGON	
PENNSYLVANIA	4	63,197	710	62,487	-	62,487	-	8	-	*	8	62,495	-	62,495	PENNSYLVANIA	
RHODE ISLAND	3	4,277	-	4,277	336	3,981	4	-	-	-	4	3,985	-	3,985	RHODE ISLAND	
SOUTH CAROLINA	6	13,899	-	13,899	277	13,622	-	288	-	-	288	13,910	73	13,837	SOUTH CAROLINA	
SOUTH DAKOTA	4	5,827	205	5,622	1,169	4,453	74	-	-	-	74	4,527	16	4,511	SOUTH DAKOTA	
TENNESSEE	7	21,245	-	21,245	133	21,112	-	1,146	-	62	1,208	22,320	142	22,178	TENNESSEE	
TEXAS	4	55,903	557	55,346	7,828	47,518	-	-	-	12	47,530	-	47,530	TEXAS		
UTAH	4	4,117	62	4,055	-	4,055	*	-	1	*	1	4,056	68	3,988	UTAH	
VERMONT	4	2,781	-	2,781	-	2,781	-	-	*	-	2,781	-	2,781	VERMONT		
VIRGINIA	5	20,645	-	20,645	1,241	19,404	1	-	4	1	6	19,410	16	19,396	VIRGINIA	
WASHINGTON	5	18,732	94	18,638	1,066	17,172	3	-	-	-	13	17,185	-	17,185	WASHINGTON	
WEST VIRGINIA	5	40,981	-	40,981	301	10,680	11	-	-	-	11	10,691	-	10,691	WEST VIRGINIA	
WISCONSIN	4	22,861	-	22,861	1,711	21,150	-	161	-	-	161	21,311	-	21,311	WISCONSIN	
WYOMING	4	2,772	-	2,772	-	2,772	2	-	-	-	2	2,774	54	2,720	WYOMING	
DISTRICT OF COLUMBIA	2	3,244	-	3,244	22	3,222	7	-	-	-	7	3,229	-	3,229	DISTRICT OF COLUMBIA	
TOTAL		2/ 3.96	918,847	4,358	914,489	50,017	864,472	495	5,473	44	208	6,220	870,692	556	870,136	TOTAL

^{1/} THE STATES FOR WHICH AMOUNTS ARE SHOWN MAKE ALLOWANCES TO DISTRIBUTORS FOR EXPENSE OF COLLECTING THE TAX. IN KENTUCKY, SOUTH DAKOTA, UTAH, AND WASHINGTON ALLOWANCES OF 2 1/2, 4, 2 AND 6 PERCENT, RESPECTIVELY, OF THE TAX OTHERWISE DUE ARE MADE IN CONSIDERATION OF BOTH EXPENSE OF COLLECTION AND GALLONAGE LOSSES IN HANDLING. IN THESE STATES THE ALLOWANCES FOR EXPENSES ONLY HAVE BEEN ESTIMATED AS 1, 3 1/2, 1 1/2, AND 4 PERCENT, RESPECTIVELY.

^{2/} STARS INDICATE AMOUNTS LESS THAN \$500.

^{3/} FEES FOR INSPECTION OF MOTOR-VEHICLE FUEL. WHEREVER POSSIBLE, FEES FOR INSPECTION OF KEROSENE AND OTHER NON-MOTOR-VEHICLE FUELS HAVE BEEN ELIMINATED.

^{4/} RATE CHANGED FROM 4 CENTS TO 2 CENTS SEPTEMBER 1.
^{5/} SPECIAL COUNTIES TAKE 3 CENTS PER GALLON IN HANCOCK COUNTY AND 2 CENTS PER GALLON IN HARRISON AND JACKSON COUNTIES, AMOUNTING TO \$197,000 IN 1940.

FOR SEAWALL PROTECTION AND ARE NOT INCLUDED IN THIS TABLE.

^{6/} OHIO IMPOSES A 3-CENT TAX ON MOTOR-VEHICLE FUEL AND A 1-CENT TAX ON ALL LIQUID FUELS. THE RECEIPTS FROM THE 1-CENT TAX APPLICABLE TO NON-MOTOR-VEHICLE FUELS (KEROSENE, FUEL OIL, ETC.) WERE \$638,000. THESE RECEIPTS HAVE BEEN ELIMINATED FROM THE TOTAL GIVEN, WHICH REPRESENTS A 5-CENT TAX ON MOTOR-VEHICLE FUEL.

^{7/} WEIGHTED AVERAGE RATE.

PUBLIC ROADS

STATE MOTOR-VEHICLE REGISTRATIONS - 1940

COMPILED FOR CALENDAR YEAR FROM REPORTS OF STATE AUTORITIES

TABLE M-1, 1940
ISSUED MAY 1941

STATE	MOTOR VEHICLES			TRAILERS AND SEMI TRAILERS			MOTORCYCLES			DEALERSHIP			1939			1940			
	PRIVATE AND COMMERCIAL			PUBLICLY OWNED			PRIVATE AND COMMERCIAL			PRIVATE AND COMMERCIAL			REGISTRATIONS			REGISTRATIONS			
	TOTAL	TOTAL	PASSENGER VEHICLES	TOTAL	AUTOMOBILES	(INC. COMMERCIAL TRUCKS)	FEDERAL	STATE	COUNTY AND MUNICIPAL	FEDERAL	STATE	COUNTY AND MUNICIPAL	FEDERAL	STATE	COUNTY AND MUNICIPAL	FEDERAL	STATE	COUNTY AND MUNICIPAL	
ALABAMA	347,123	359,835	277,006	773,714	3,952	62,437	7,270	2,534	5,253	5,323	60	221	1,059	1,012	57	3,920	1,184	1,040	
AKRON, OHIO	1,841,472	1,854,472	1,691,013	2,045,928	1,936,983	1,651,585	1,303	62,150	2,370	2,452	1,032	50	144	635	111	6	1,143	154,111	140,400
ARMENIA	26,892	27,775	2,777,659	2,453,958	2,453,958	2,453,958	1,130	65,158	1,850	2,370	11,261	11,459	167,829	17,482	17,477	151,901	2,388	2,388	16,230
CALIFORNIA	2,810,560	3,552,110	292,782	4,851,626	1,166	58,318	3,159	*	1,640	1,640	1,640	37	1,592	1,579	13	-	4,350	365,885	345,277
CONNECTICUT	4,804,463	4,931,667	4,117,828	6,478,828	6,478,828	6,478,828	1,172	58,879	4,796	6,478	6,478	18	207	2,070	2,001	18	3,001	69,109	33,117
DELAWARE	72,973	71,703	60,209	81,957	81,957	81,957	1,210	4,27	783	3,417	3,417	9	33	1,359	1,359	5	885	3,164	5,063
FLORIDA	5,029,678	5,455,210	4,154,420	6,154,420	6,154,420	6,154,420	1,172	58,879	6,148	6,088	6,088	46	1,906	1,756	1,697	18	2,397	69,109	5,063
GEORGIA	513,097	522,603	415,421	528,882	528,882	528,882	1,172	10,494	4,994	5,523	5,523	18,088	1,026	1,026	1,026	11	1,348	2,555	1,713
ILLINOIS	1,167,700	1,165,510	1,165,510	1,165,510	1,165,510	1,165,510	1,172	1,165	1,165	1,165	1,165	12	22,184	18,920	18,920	12	2,020	1,730	1,730
INDIANA	1,001,124	1,001,124	999,006	1,001,124	1,001,124	1,001,124	1,172	1,001	1,001	1,001	1,001	12	1,172	1,172	1,172	12	1,060	1,060	1,060
KANSAS	852,285	793,965	691,257	840,002	840,002	840,002	1,172	816	915	960	960	12	2,977	2,874	2,874	12	2,397	2,765	2,765
KENTUCKY	372,810	370,825	365,429	370,825	370,825	370,825	1,172	1,712	1,712	1,712	1,712	12	1,340	1,262	1,262	12	1,191	1,262	1,262
Louisiana	208,559	208,559	161,982	210,973	210,973	210,973	1,172	1,712	1,712	1,712	1,712	12	1,979	1,931	1,931	12	1,659	2,010	2,010
Maine	1,045,979	1,045,979	844,559	1,045,979	1,045,979	1,045,979	1,172	844,559	844,559	844,559	844,559	12	2,006	1,152	1,152	12	1,759	4,862	4,862
MARYLAND	1,045,979	1,045,979	844,559	1,045,979	1,045,979	1,045,979	1,172	844,559	844,559	844,559	844,559	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Massachusetts	1,552,571	1,552,571	1,552,571	1,552,571	1,552,571	1,552,571	1,172	1,552,571	1,552,571	1,552,571	1,552,571	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Michigan	1,552,571	1,552,571	1,552,571	1,552,571	1,552,571	1,552,571	1,172	1,552,571	1,552,571	1,552,571	1,552,571	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Minnesota	2,063,862	2,063,862	1,671,351	2,063,862	2,063,862	2,063,862	1,172	1,671,351	1,671,351	1,671,351	1,671,351	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Mississippi	263,439	291,013	198,086	263,439	263,439	263,439	1,172	198,086	198,086	198,086	198,086	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Montana	198,116	191,052	143,066	191,052	191,052	191,052	1,172	198,116	198,116	198,116	198,116	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Nebraska	417,827	412,116	347,627	412,116	412,116	412,116	1,172	347,627	347,627	347,627	347,627	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Nevada	1,165,159	1,165,159	1,165,159	1,165,159	1,165,159	1,165,159	1,172	1,165,159	1,165,159	1,165,159	1,165,159	12	1,759	1,152	1,152	12	1,040	3,210	3,210
New Hampshire	1,165,159	1,165,159	1,165,159	1,165,159	1,165,159	1,165,159	1,172	1,165,159	1,165,159	1,165,159	1,165,159	12	1,759	1,152	1,152	12	1,040	3,210	3,210
New Jersey	1,165,159	1,165,159	1,165,159	1,165,159	1,165,159	1,165,159	1,172	1,165,159	1,165,159	1,165,159	1,165,159	12	1,759	1,152	1,152	12	1,040	3,210	3,210
New Mexico	1,165,159	1,165,159	1,165,159	1,165,159	1,165,159	1,165,159	1,172	1,165,159	1,165,159	1,165,159	1,165,159	12	1,759	1,152	1,152	12	1,040	3,210	3,210
New York	2,778,312	2,743,014	2,407,253	2,743,014	2,743,014	2,743,014	1,172	7,315	7,315	7,315	7,315	12	1,759	1,152	1,152	12	1,040	3,210	3,210
North Carolina	610,121	591,946	454,489	610,121	610,121	610,121	1,172	7,315	7,315	7,315	7,315	12	1,759	1,152	1,152	12	1,040	3,210	3,210
North Dakota	188,470	182,707	145,746	188,470	188,470	188,470	1,172	182,707	182,707	182,707	182,707	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Ohio	1,984,659	1,984,659	1,984,659	1,984,659	1,984,659	1,984,659	1,172	1,984,659	1,984,659	1,984,659	1,984,659	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Oklahoma	2,169,725	2,178,275	1,748,275	2,178,275	2,178,275	2,178,275	1,172	2,169,725	2,169,725	2,169,725	2,169,725	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Pennsylvania	2,169,725	2,169,725	1,849,959	2,169,725	2,169,725	2,169,725	1,172	1,849,959	1,849,959	1,849,959	1,849,959	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Rhode Island	1,165,159	1,165,159	1,165,159	1,165,159	1,165,159	1,165,159	1,172	1,165,159	1,165,159	1,165,159	1,165,159	12	1,759	1,152	1,152	12	1,040	3,210	3,210
South Carolina	343,488	343,777	290,968	343,488	343,488	343,488	1,172	343,488	343,488	343,488	343,488	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Tennessee	919,415	915,607	747,931	919,415	919,415	919,415	1,172	747,931	747,931	747,931	747,931	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Texas	1,519,313	1,447,170	777,316	1,519,313	1,519,313	1,519,313	1,172	1,519,313	1,519,313	1,519,313	1,519,313	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Utah	133,928	139,591	139,591	133,928	133,928	133,928	1,172	133,928	133,928	133,928	133,928	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Vermont	529,115	482,978	422,038	529,115	529,115	529,115	1,172	422,038	422,038	422,038	422,038	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Washington	324,480	324,480	290,968	324,480	324,480	324,480	1,172	290,968	290,968	290,968	290,968	12	1,759	1,152	1,152	12	1,040	3,210	3,210
West Virginia	913,055	905,915	855,657	913,055	913,055	913,055	1,172	751,931	751,931	751,931	751,931	12	1,759	1,152	1,152	12	1,040	3,210	3,210
Wyoming	88,120	163,105	163,105	163,105	163,105	163,105	1,172	163,105	163,105	163,105	163,105	12	1,759	1,152	1,152	12	1,040	3,210	3,210
WYOMING, WYOMING	163,105	163,105	163,105	163,105	163,105	163,105	1,172	163,105	163,105	163,105	163,105	12	1,759	1,152	1,152	12	1,040	3,210	3,210
WYOMING, WYOMING	163,105	163,105	163,105	163,105	163,105	163,105	1,172	163,105	163,105	163,105	163,105	12	1,759	1,152	1,152	12	1,040	3,210	3,210
YUCCA, YUCCA	3,467	3,467	3,467	3,467	3,467	3,467	1,172	3,467	3,467	3,467	3,467	12	1,759	1,152	1,152	12	1,040	3,210	3,210
ZEPHYRUS, ZEPHYRUS	3,467	3,467	3,467	3,467	3,467	3,467	1,172	3,467	3,467	3,467	3,467	12	1,759	1,152	1,152	12	1,040	3,210	3,210
TOTAL	32,452,861	32,025,365	27,434,979	32,452,861	32,452,861	32,452,861	1,172	27,434,979	27,434,979										

STATE MOTOR-VEHICLE RECEIPTS - 1940

COMPILED FOR CALENDAR YEAR FROM REPORTS OF STATE AUTHORITIES ^{1/}TABLE NO. 2, 1940
ISSUED MAY 1941

STATE	REGISTRATION FEES ^{2/}										MISCELLANEOUS RECEIPTS										STATE	
	MOTOR VEHICLES			OTHER VEHICLES			DEALER'S			OPERATORS			CERTIFI-	TITLING	TRANSFER	MAILED	RECEIPTS					
	PASSENGER VEHICLES	AUTO- MOBILES	BUSES	TOTAL	TRAILERS	MOTOR- CYCLES	TOTAL	DEALER'S	LICENSES	CHAUFF- EUR'S	FEES	FEES	SPECIAL	TITLING	TRANSFER	MAILED	RECEIPTS	LEGISLATION	UNCLAS- SIFIED	REFUNDS		
	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000		
ALABAMA	\$6,548	"	"	"	410	460	4,244	3	125	"	80	"	170	"	9	14	"	6	6	30	30	ALABAMA
ARIZONA	1,225	1,034	27	1,918	1,015	2,959	2,959	6	3,107	73	206	"	140	9	140	9	2	2	261	292	ARIZONA	
CALIFORNIA ^{3/}	27,914	19,751	60	19,751	4,747	2,170	1,188	79	2,211	32	1,764	1,764	163	161	197	1,522	"	62	586	586	CALIFORNIA ^{3/}	
COLORADO	9,169	"	"	"	1,089	9,481	2,170	23	6	4,791	1,184	1,07	62	93	29	1	1	282	282	CONNECTICUT		
CONNECTICUT	7,385	3,031	132	7,385	3,163	1,599	899	44	1	944	25	1,19	260	"	129	23	9	208	208	DELAWARE		
DELAWARE	1,252	583	211	1,252	1,216	899	899	9	7,455	2,170	1,192	1,192	1,192	1,192	1,192	1,192	1,192	1,192	1,192	1,192	FLORIDA	
FLORIDA	8,002	"	"	"	1,059	134	1,492	584	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	GEORGIA	
GEORGIA	2,768	"	"	"	1,057	535	1,182	2,170	1,192	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	GEORGIA	
IDAHO	1,401	1,648	9	1,648	1,563	6,771	6,771	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	IDAHO	
ILLINOIS	26,700	15,631	12,101	20,700	6,982	1,791	1,791	381	10	8,764	52	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	ILLINOIS
INDIANA	10,590	9,268	(7)	9,268	3,163	12,264	212	11	12,577	199	1,168	87	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	INDIANA
IOWA	15,297	9,268	(7)	9,268	2,056	1,165	1,165	69	5	3,255	25	564	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	IOWA
KANSAS	4,032	2,676	(7)	2,676	1,292	3,228	3,228	120	3	2,231	25	548	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	KANSAS
KENTUCKY	5,509	1,829	107	5,509	1,926	1,237	1,237	65	6	5,242	11	105	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	KENTUCKY
LOUISIANA	5,392	3,235	107	5,392	1,237	1,237	1,237	701	6	5,242	11	105	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	LOUISIANA
MAINE	1,652	2,689	13	2,689	1,088	1,284	1,284	105	11	1,191	29	70	533	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	MAINE
MASSACHUSETTS	6,458	2,950	150	6,458	4,488	4,488	4,488	4,488	4	4,488	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	MASSACHUSETTS	
MICHIGAN	20,115	12,121	(7)	12,121	5,193	5,193	5,193	20,001	1	2,290	99	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	MICHIGAN
MINNESOTA	10,305	7,230	105	7,230	2,081	9,476	9,476	373	8	9,977	59	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	MINNESOTA
MISSOURI	36,029	7,645	(7)	7,645	1,745	1,745	1,745	1,745	1	9,159	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	MISSOURI	
PONTIAC ^{3/}	1,721	937	(7)	937	1,370	1,370	1,370	1,370	27	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	PONTIAC ^{3/}	
NEBRASKA	2,359	1,301	"	2,359	1,188	1,188	1,188	1,188	25	2,311	62	7	2,375	26	138	1,168	1,168	1,168	1,168	1,168	NEBRASKA	
NEW HAMPSHIRE	313	176	1	176	1,117	1,117	1,117	1,117	10	1,117	1,117	1,117	1,117	1,117	1,117	1,117	1,117	1,117	1,117	1,117	NEW HAMPSHIRE	
NEW JERSEY	3,052	1,471	"	1,471	1,117	1,117	1,117	1,117	384	1,117	1,117	1,117	1,117	1,117	1,117	1,117	1,117	1,117	1,117	1,117	NEW JERSEY	
NEW YORK	1,994	989	63	1,994	1,052	1,701	1,701	1,701	56	1,683	47	4,700	2,170	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	NEW YORK
NORTH CAROLINA	55,944	31,977	12,399	55,944	1,745	1,745	1,745	1,745	35	7,316	7,316	7,316	7,316	7,316	7,316	7,316	7,316	7,316	7,316	7,316	NORTH CAROLINA	
NORTH DAKOTA	1,661	1,674	14	1,674	1,179	1,179	1,179	1,179	345	1,524	5	1,530	21	22	63	59	59	59	59	59	NORTH DAKOTA	
OHIO	30,770	15,891	(7)	15,891	8,578	8,578	8,578	8,578	1	8,578	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	OHIO	
OKLAHOMA	6,435	2,584	235	6,435	2,619	1,591	1,591	1,591	44	4,333	648	6	4,987	52	272	813	813	115	813	813	OKLAHOMA	
OREGON	3,346	1,626	63	1,626	1,669	1,669	1,669	1,669	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	OREGON		
PENNSYLVANIA	39,891	20,584	601	20,584	9,150	30,255	30,255	30,255	35	30,906	409	30,906	409	30,906	409	30,906	409	30,906	30,906	30,906	PENNSYLVANIA	
RHODE ISLAND	3,218	1,920	40	1,920	1,966	533	533	533	3	1,613	1,613	1,613	1,613	1,613	1,613	1,613	1,613	1,613	1,613	1,613	RHODE ISLAND	
SOUTH CAROLINA	1,794	1,861	39	1,861	920	693	693	693	1	1,733	1,733	1,733	1,733	1,733	1,733	1,733	1,733	1,733	1,733	1,733	SOUTH CAROLINA	
TAHOMA DISTRICT	5,330	5,324	4	5,324	1,438	233	233	233	1	1,691	1,691	1,691	1,691	1,691	1,691	1,691	1,691	1,691	1,691	1,691	TAHOMA DISTRICT	
TEXAS	22,422	13,258	154	13,258	1,1412	2,052	2,052	2,052	627	21	21,190	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	TEXAS
VERMONT	2,427	1,500	(7)	1,500	1,071	1,071	1,071	1,071	1	1,071	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	VERMONT	
VIRGINIA	2,155	1,427	13	1,427	1,512	1,512	1,512	1,512	42	2,152	7	6,409	69	299	299	299	299	299	299	299	299	VIRGINIA
WASHINGTON	3,728	2,427	68	2,427	1,955	1,955	1,955	1,955	27	2,322	310	7	3,049	15	1,700	1,700	1,700	1,700	1,700	1,700	1,700	WASHINGTON
WEST VIRGINIA	3,418	3,863	27	3,418	3,910	1,168	1,168	1,168	44	5,018	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	WEST VIRGINIA	
WISCONSIN	13,475	9,729	168	9,729	9,907	2,543	2,543	2,543	220	2,650	16	12,754	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	WISCONSIN
WYOMING	603	3,324	16	3,324	320	320	320	320	481	1,257	22	3,192	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	1,168	WYOMING
DISTRICT OF COLUMBIA	1,751	1,780	-	1,780	796	16	361,231	-	-	361,231	-	-	2,668	2,668	2,668	2,668	2,668	2,668	2,668	2,668	2,668	DISTRICT OF COLUMBIA
PARTIAL TOTALS ^{1/}	-	245,001	3,251	248,252	98,206	-	-	361,231	-	-	361,231	-	-	2,668	2,668	2,668	2,668	2,668	2,668	2,668	2,668	PARTIAL TOTALS ^{1/}
FULL TOTALS	439,178	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	FULL TOTALS	

^{1/} RECEIPTS FOR INCUBATION PERIODS ENDING NOT LATER THAN JANUARY 31, ARE RECEIVED IN A LENGTHENED PERIOD, IN THOSE STATES WHERE THE REGISTRATION-TAX PERIOD IS DEFINITELY REPORTED.

^{2/} THE CALENDAR YEAR. REGISTRATION FEES IN THOSE STATES WHERE THE CALENDAR-YEAR PERIOD IS DEFINITELY REPORTED.

^{3/} HAMMOCKS, TENTS, AND TRAILERS, FOR WHICH MOTOR-VEHICLE REGISTRATION FEES ARE INCLUDED WITH MOTOR-VEHICLE REGISTRATION FEES.

^{4/} IN THE MAJORITY OF CASES, THESE FEES ARE INCLUDED WITH MOTOR-VEHICLE REGISTRATION FEES.

^{5/} IN THE PLEASANT HARBOR AREA, THE FEES FOR AUTOMOBILES ARE INCLUDED WITH THOSE FOR PASSENGER CARS.

^{6/} IN THE STATE OF ALABAMA, THE FEES FOR AUTOMOBILES ARE INCLUDED WITH THOSE FOR PASSENGER CARS.

STATUS OF FEDERAL-AID HIGHWAY PROJECTS

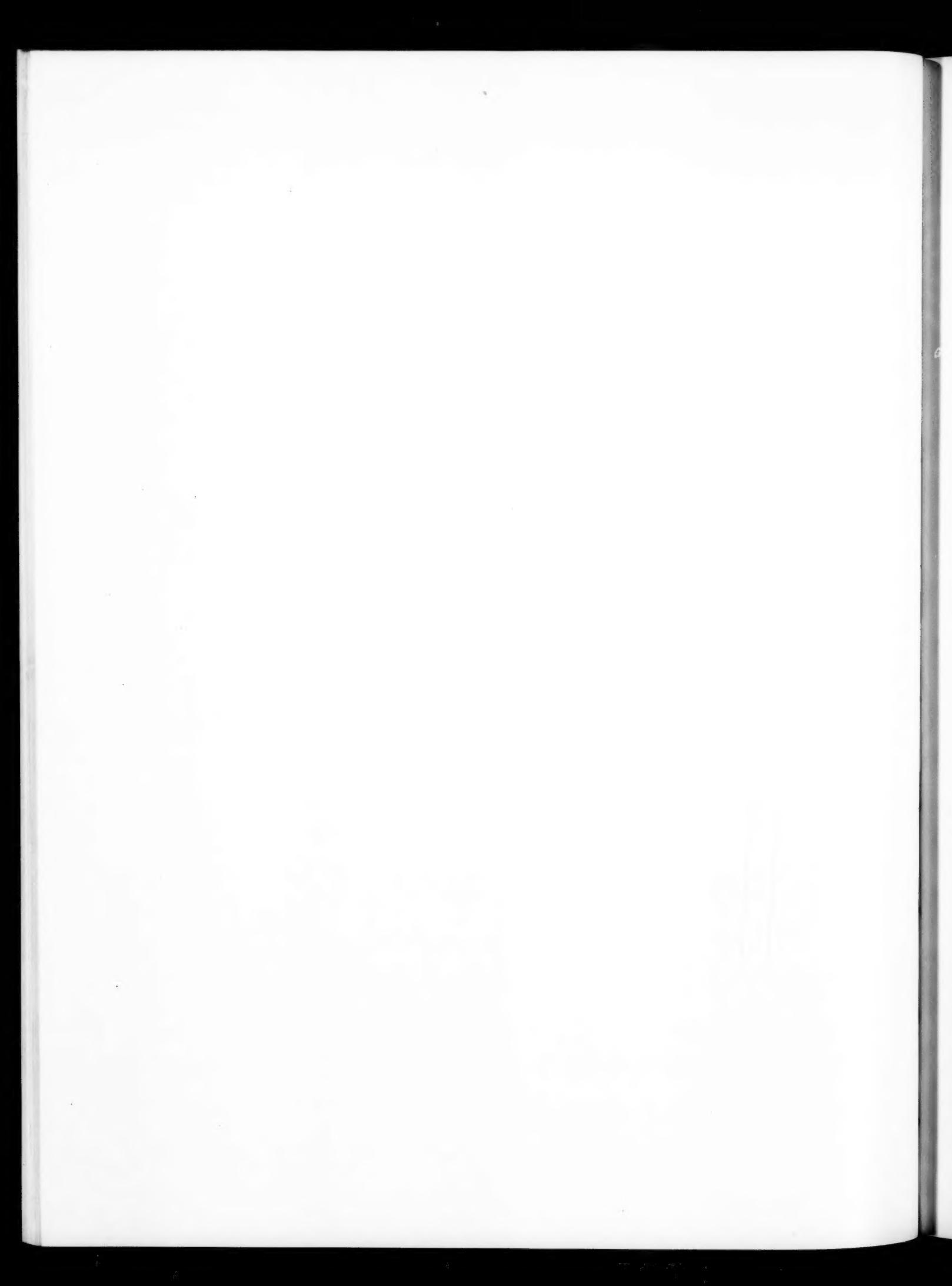
AS OF MAY 31, 1941

STATE	COMPLETED DURING CURRENT FISCAL YEAR			UNDER CONSTRUCTION			APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAILABLE FOR GRANT AND PAYMENTS PENDING
	Estimated Total Cost	Federal Aid	Miles	Estimated Total Cost	Federal Aid	Miles	Estimated Total Cost	Federal Aid	Miles	
Alabama	\$ 4,532,129	\$ 2,119,682	105.9	\$ 6,463,196	\$ 2,214,205	237.0	\$ 1,790,100	\$ 887,150	57.4	\$ 2,105,720
Arkansas	1,658,892	1,117,267	62.2	1,704,502	1,168,488	79.0	235,615	136,349	1.7	1,636,860
Arizona	5,130,207	2,347,985	130.2	1,756,545	675,186	54.5	675,098	337,525	37.8	1,387,624
California	7,182,005	3,003,969	133.6	8,670,313	4,675,226	125.2	2,103,523	1,096,376	41.7	3,394,309
Colorado	2,529,042	1,364,397	199.2	2,314,465	1,363,086	104.9	430,911	69,6	2,961,986	
Connecticut	1,952,321	945,967	16.2	1,764,135	868,069	15.1	575,267	220,284	1,050,689	
Delaware	1,927,921	962,182	36.5	361,405	180,352	4.5	639,356	276,669	22.6	1,184,811
Florida	5,692,499	1,813,691	85.2	174,116	49,9	656,518	320,006	13.7	3,545,700	
Georgia	3,412,741	1,652,691	199.5	7,068,427	3,511,463	278.1	2,282,339	1,161,720	109.1	6,555,207
Idaho	2,047,494	1,155,675	151.2	1,434,790	684,183	64.2	821,892	395,342	42.9	1,789,709
Illinois	7,171,478	3,504,887	157.9	6,554,046	4,277,773	180.7	1,909,052	949,470	141.0	4,597,913
Indiana	5,161,792	2,814,924	127.2	8,094,056	3,828,537	128.8	99,166	17,933	16.2	2,209,432
Iowa	5,624,075	2,660,020	198.2	4,719,139	2,268,158	161.1	1,692,912	869,050	90.2	1,514,347
Kansas	5,131,145	2,480,080	470.5	5,485,031	2,746,583	280.9	1,922,992	1,942,461	216.3	4,124,962
Kentucky	3,068,125	1,492,936	91.1	3,731,523	1,816,542	112.8	4,947,660	2,897,595	121.0	2,028,201
Louisiana	11,385,161	2,910,510	39.4	2,375,813	1,187,148	55.2	1,566,015	773,850	38.9	3,717,386
Maine	6,385,161	676,459	31.0	1,539,547	791,913	19.8	966,842	483,005	20.6	559,563
Maryland	1,875,588	623,817	29.1	3,665,235	1,531,513	23.9	4,505,900	135,000	2.3	1,759,504
Massachusetts	6,385,064	916,828	22.9	2,758,736	1,400,529	19.7	2,059,810	1,025,825	15.0	3,019,341
Michigan	6,455,327	2,922,911	228.1	9,406,920	4,690,860	214.0	585,400	894,700	9.1	2,499,398
Minnesota	3,150,021	1,113,854	531.9	5,458,736	2,719,077	4,195,944	2,080,657	2,897,595	23.5	3,099,985
Mississippi	2,619,467	1,783,975	139.5	7,982,716	3,910,558	453.6	852,700	121.0	124,7006	
Montana	4,621,688	2,621,088	179.9	10,383,487	4,259,023	285.6	5,900,076	2,271,030	163.0	3,622,252
Nebraska	9,900,669	2,298,927	578.4	4,631,382	2,335,729	472.1	1,007,547	572,891	52.2	4,045,692
Nevada	1,585,633	1,342,400	80.0	1,761,074	1,778,267	79.2	1,010,137	1,94,058	17.5	2,797,588
New Hampshire	2,228,202	1,600,555	42.1	428,298	211,890	8.4	546,446	271,374	5.3	658,339
New Jersey	2,554,309	1,266,942	13.3	6,533,502	3,266,671	50.7	27,110	13,552	1,041,492	
New Mexico	2,913,097	1,803,575	215.6	1,103,838	679,182	51.4	504,907	326,473	1,930,106	
New York	11,425,612	5,519,395	199.0	11,981,290	5,666,392	152.0	1,334,4	534,522	16.6	4,471,711
North Carolina	4,406,245	2,200,808	235.0	5,020,434	2,894,170	244.6	747,530	156,592	32.4	2,738,366
North Dakota	2,084,039	1,101,526	212.6	3,688,594	2,058,721	292.5	1,839,660	929,613	194.4	4,326,726
Ohio	7,228,202	3,600,519	92.4	14,856,765	7,405,085	123.9	5,293,948	2,901,348	2,307,8	3,632,335
Oklahoma	3,361,644	1,778,255	121.5	2,999,424	1,529,420	98.0	3,312,440	1,213,896	89,0	4,850,065
Oregon	3,480,704	1,307,317	160.4	3,830,882	2,063,246	111.8	1,195,063	671,410	10.6	861,892
Pennsylvania	8,126,306	3,999,124	100.0	14,057,274	6,923,640	118.3	1,918,908	965,200	19.9	3,546,790
Rhode Island	5,612,140	13.2	1,182,916	550,892	9.9	197,310	98,555	1,075,517	2,133,518	
South Carolina	2,510,534	1,211,198	190.0	4,073,487	1,903,387	135.4	1,818,810	1,131,370	161.1	2,281,129
Washington	3,232,680	1,684,453	500.6	4,451,883	2,770,573	543.9	1,131,370	659,700	181.1	1,707,918
Tennessee	3,421,603	1,694,964	75.1	5,192,586	2,596,898	152.9	1,943,892	1,711,946	19.8	3,631,042
Texas	8,970,044	4,367,317	520.0	10,099,811	6,519,759	605.9	3,077,165	1,35,470	185.8	7,118,925
Utah	1,078,325	766,201	75.0	1,731,476	1,202,733	56.9	635,822	393,059	80.7	900,113
Vermont	1,308,660	684,484	37.6	1,092,828	552,592	31.8	387,654	189,116	6.1	404,355
Virginia	3,118,810	1,476,053	80.0	4,544,042	2,127,804	75.5	1,557,692	589,548	30.7	1,920,472
Washington	4,443,677	2,283,267	91.4	2,011,112	1,073,049	23.6	1,443,258	225,015	4.0	1,636,797
West Virginia	2,188,128	1,083,857	76.4	4,175,160	2,080,587	80.1	364,570	182,218	5.2	1,707,918
Wyoming	5,707,854	2,801,205	201.7	3,322,886	1,652,288	123.1	683,992	318,740	20.3	4,621,835
District of Columbia	1,880,709	1,111,594	196.3	1,843,380	1,199,056	180.7	275,927	154,716	20.2	1,225,788
Hawaii	498,667	299,021	5.1	828,211	413,969	2.6	38,944	19,472	1.1	440,850
Puerto Rico	238,503	167,392	6.0	546,698	282,595	7.8	267,936	131,600	2.1	1,973,814
TOTALS	195,999,193	95,650,084	7,834.8	231,199,283	118,149,142	7,200.8	72,570,531	35,311,998	2,716.3	128,919,840

STATUS OF FEDERAL-AID SECONDARY OR FEEDER ROAD PROJECTS

AS OF MAY 31, 1941

STATE	COMPLETED DURING CURRENT FISCAL YEAR			UNDER CONSTRUCTION			APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAIL. FOR MAJOR PROJECTS
	Estimated Total Cost	Federal Aid	Miles	Estimated Total Cost	Federal Aid	Miles	Estimated Total Cost	Federal Aid	Miles	
Alabama	\$ 190,944	\$ 25,263	9.3	\$ 1,333,057	* 667,758	60.6	\$ 41,700	\$ 20,850	0.1	\$ 607,504
Arizona	240,302	158,515	23.6	202,398	149,842	52.3	50,713	31,587	6.7	365,891
Arkansas	462,512	202,807	14.9	412,654	205,474	32.6				209,896
California	1,056,411	564,761	40.5	1,177,912	850,599	13.8	429,723	226,939	12.1	466,549
Colorado	276,356	154,751	9.6	175,652	98,569	28.7				345,719
Connecticut	370,531	173,513	4.6	295,035	156,331	6.1				187,820
Delaware	127,253	63,687	12.7	46,421	22,615	2.9	256,891	118,835	12.3	281,684
Florida	91,270	45,287	8.7	1,096,579	547,839	11.7				285,907
Georgia	296,304	147,033	26.9	940,928	671,815	67.6	346,285	173,262	34.2	1,151,507
Idaho	1,766,825	91,044	24.0	289,104	174,199	13.8	18,414	9,852	2.5	287,016
Illinois	829,343	829,343	80.6	1,193,850	581,985	94.0	616,290	368,050	36.2	426,478
Indiana	1,771,750	1,152,327	31.0	152,916	161,919	18.9	1,464,471	629,716	69.3	690,475
Iowa	2,441,932	1,160,111	54.1	645,074	302,785	179.2	143,140	56,062	31.2	448,500
Kansas	396,841	191,497	50.2	644,651	430,895	45.6	1,265,141	635,170	123.5	1,018,002
Kentucky	268,285	67.5	762,455	214,987	266.7	1,035,400	253,911	74.1	138,487	
Louisiana	112,956	52,651	10.9	564,708	230,889	20.2	168,715	61,358	14.6	500,503
Maine	303,654	129,080	17.0	40,606	20,303	1.5				161,212
Maryland	128,300	64,120	5.5	451,250	222,695	11.3	117,500	47,090	4.8	330,351
Massachusetts	523,220	259,348	10.5	177,572	104,717	3.4	605,103	301,067	10.8	218,087
Michigan	1,582,408	718,209	128.6	805,460	402,730	139.2	513,900	256,990	40.1	604,954
Minnesota	793,611	382,532	122.5	1,133,295	271,047	139.4	123,498	179,358	51.7	940,987
Mississippi	278,087	131,760	12.5	982,194	465,947	51.9	209,800	93,365	9.3	651,872
Missouri	762,270	376,672	103.9	386,116	251,075	25.0	666,166	275,636	75.1	869,697
Montana	712,410	402,585	98.0	389,640	220,819	36.2	279,232	158,599	54.2	689,537
Nebraska	751,852	356,768	119.3	432,690	211,126	48.3	357,828	176,562	45.6	389,955
New Hampshire	206,236	167,599	40.9	186,061	161,918	19.6	97,167	61,959	4.5	163,063
New Jersey	143,639	66,883	3.4	71,533	34,906	3.6	83,573	41,587	1.7	161,693
New Mexico	390,998	195,060	18.3	337,342	188,185	17.2	436,810	218,405	12.7	443,889
New York	445,310	225,966	25.8	395,008	255,715	21.9	150,634	96,358	86.6	280,206
North Carolina	2,357,156	1,117,810	77.9	1,229,034	621,921	30.2				818,145
North Dakota	1,001,189	497,219	83.4	604,092	304,628	51.8	102,860	51,180	15.3	442,357
Ohio	80,071	42,552	3.3	136,016	74,406	3.5	460,180	223,915	5.3	1,276,906
Oklahoma	1,710,348	848,861	59.8	2,064,710	1,079,580	60.9	446,130	251,787	4.2	923,308
Oregon	795,576	416,089	27.1	301,276	129,134	11.8	176,886	100,090	16.4	961,569
Pennsylvania	407,563	227,326	61.3	370,544	167,124	27.2	1,295,210	385,969	13.3	331,018
Rhode Island	1,728,851	846,811	59.9	1,632,169	615,154	34.4				182,113
South Dakota	262,488	120,587	3.6	97,806	50,516	1.9	121,812	50,435	1.7	63,989
Tennessee	647,847	236,916	90.4	668,457	256,366	51.0	317,700	160,184	11.5	159,846
Texas	3,714	3,624	23.9	25,302	15,758	9.0	9,240	5,190	6.2	1,521,964
Utah	150,895	71,863	6.7	287,466	141,723	10.0	1,355,360	677,790	48.2	558,227
Vermont	1,517,781	712,578	202.0	1,185,396	587,563	111.5	355,820	142,900	39.3	1,465,564
Virginia	523,296	110,320	23.9	236,725	156,413	13.8	12,539	16,780	9.4	211,407
Washington	284,363	28.1	113.1	411,868	198,931	16.4	319,464	136,740	3.9	360,410
West Virginia	631,615	311.0	165,002	508,263	267,828	26.0				252,848
Wyoming	324,392	161,299	7.4	285,050	142,585	7.9	318,997	342,962	35.6	310,590
District of Columbia	228,957	161,299	42.4	920,133	468,153	32.6	819,384	16,360	55.1	554,741
Puerto Rico	112,164	58,028	1.4	369,792	156,928	16.4	30,599	14,750	3.3	73,194
TOTALS	30,267,445	14,796,468	2,554.3	27,861,813	14,215,016	1,544.3	15,867,305	7,386,545	1,047.7	24,681,003



PUBLICATIONS of the PUBLIC ROADS ADMINISTRATION

Any of the following publications may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C. As his office is not connected with the Agency and as the Agency does not sell publications, please send no remittance to the Federal Works Agency.

ANNUAL REPORTS

- Report of the Chief of the Bureau of Public Roads, 1931. 10 cents.
Report of the Chief of the Bureau of Public Roads, 1933. 5 cents.
Report of the Chief of the Bureau of Public Roads, 1934. 10 cents.
Report of the Chief of the Bureau of Public Roads, 1935. 5 cents.
Report of the Chief of the Bureau of Public Roads, 1936. 10 cents.
Report of the Chief of the Bureau of Public Roads, 1937. 10 cents.
Report of the Chief of the Bureau of Public Roads, 1938. 10 cents.
Report of the Chief of the Bureau of Public Roads, 1939. 10 cents.

HOUSE DOCUMENT NO. 462

- Part 1 . . . Nonuniformity of State Motor-Vehicle Traffic Laws. 15 cents.
Part 2 . . . Skilled Investigation at the Scene of the Accident Needed to Develop Causes. 10 cents.
Part 3 . . . Inadequacy of State Motor-Vehicle Accident Reporting. 10 cents.
Part 4 . . . Official Inspection of Vehicles. 10 cents.
Part 5 . . . Case Histories of Fatal Highway Accidents. 10 cents.
Part 6 . . . The Accident-Prone Driver. 10 cents.

MISCELLANEOUS PUBLICATIONS

- No. 76MP . . . The Results of Physical Tests of Road-Building Rock. 25 cents.
No. 191MP . . . Roadside Improvement. 10 cents.
No. 272MP . . . Construction of Private Driveways. 10 cents.
No. 279MP . . . Bibliography on Highway Lighting. 5 cents.
Highway Accidents. 10 cents.
The Taxation of Motor Vehicles in 1932. 35 cents.
Guides to Traffic Safety. 10 cents.
An Economic and Statistical Analysis of Highway-Construction Expenditures. 15 cents.
Highway Bond Calculations. 10 cents.
Transition Curves for Highways. 60 cents.
Highways of History. 25 cents.

DEPARTMENT BULLETINS

- No. 1279D . . . Rural Highway Mileage, Income, and Expenditures, 1921 and 1922. 15 cents.
No. 1486D . . . Highway Bridge Location. 15 cents.

TECHNICAL BULLETINS

- No. 55T . . . Highway Bridge Surveys. 20 cents.
No. 265T . . . Electrical Equipment on Movable Bridges. 35 cents.
-

Single copies of the following publications may be obtained from the Public Roads Administration upon request. They cannot be purchased from the Superintendent of Documents.

MISCELLANEOUS PUBLICATIONS

- No. 296MP . . . Bibliography on Highway Safety.
House Document No. 272 . . . Toll Roads and Free Roads.
Indexes to PUBLIC ROADS, volumes 6-8 and 10-20, inclusive.

SEPARATE REPRINT FROM THE YEARBOOK

- No. 1036Y . . . Road Work on Farm Outlets Needs Skill and Right Equipment.

TRANSPORTATION SURVEY REPORTS

- Report of a Survey of Transportation on the State Highway System of Ohio (1927).
Report of a Survey of Transportation on the State Highways of Vermont (1927).
Report of a Survey of Transportation on the State Highways of New Hampshire (1927).
Report of a Plan of Highway Improvement in the Regional Area of Cleveland, Ohio (1928).
Report of a Survey of Transportation on the State Highways of Pennsylvania (1928).
Report of a Survey of Traffic on the Federal-Aid Highway Systems of Eleven Western States (1930).

UNIFORM VEHICLE CODE

- Act I.—Uniform Motor Vehicle Administration, Registration, Certificate of Title, and Antitheft Act.
Act II.—Uniform Motor Vehicle Operators' and Chauffeurs' License Act.
Act III.—Uniform Motor Vehicle Civil Liability Act.
Act IV.—Uniform Motor Vehicle Safety Responsibility Act.
Act V.—Uniform Act Regulating Traffic on Highways.
Model Traffic Ordinances.
-

A complete list of the publications of the Public Roads Administration, classified according to subject and including the more important articles in PUBLIC ROADS, may be obtained upon request addressed to Public Roads Administration, Willard Bldg., Washington, D. C.

STATUS OF FEDERAL-AID GRADE CROSSING PROJECTS

AS OF MAY 31, 1941

STATE	COMPLETED DURING CURRENT FISCAL YEAR				UNDER CONSTRUCTION				APPROVED FOR CONSTRUCTION				BALANCE OF FUNDS AVAILABLE FOR GRADED PROJECTS			
	Estimated Total Cost	NUMBER		Estimated Total Cost	NUMBER		Estimated Total Cost	NUMBER		Grade Crossing Projects Created by Separate State or Other Subsidy	Grade Crossing Projects Created by Separate State or Other Subsidy	Grade Crossing Projects Created by Separate State or Other Subsidy				
		Federal Aid	Grade Crossing Projects Created by Separate State or Other Subsidy		Federal Aid	Grade Crossing Projects Created by Separate State or Other Subsidy		Federal Aid	Grade Crossing Projects Created by Separate State or Other Subsidy							
Alabama	\$ 285,272	* 285,169	4	\$ 649,253	* 629,200	5	\$ 145,390	* 145,390	2	2	6	* 1,014,605	207,515			
Arizona	1,200,308	194,942	3	119,779	11	1	15	154,968	239,262	2	1	3	344,619			
Arkansas	1,714,671	472,281	4	19,779	19	1	15	154,639	154,639	1	1	7	1,458,206			
California	18,356	18,386	3	380,953	850,904	2	1	150,877	684,027	2	1	1	623,495			
Colorado	632,002	611,266	5	166,222	380,255	2	1	41,032	439,793	4	1	1	561,382			
Connecticut	108,682	108,682	4	17	94,335	165,415	2	55,859	54,783	1	1	1	364,873			
Delaware	228,495	223,937	5	15	366,897	94,135	4	1	176,448	175,348	1	1	1	25,183,217		
Florida	286,047	251,148	5	13	1,212,104	1,292,104	10	2	186,859	188,859	1	1	1	1,974,385		
Georgia	302,149	291,486	5	15	14,943	14,943	10	2	217,434	217,434	1	1	1	485,592		
Idaho	1,815,943	1,811,006	10	80	1,477,555	1,477,555	5	1	77	1,041,144	1,041,144	6	6	1,990,161		
Illinois	785,008	776,856	2	87	946,240	906,252	7	1	101,550	95,841	3	1	1	956,891		
Indiana	528,992	506,257	4	98	477,490	456,245	6	2	598,159	590,415	3	42	1	791,573		
Iowa	816,246	839,306	11	18	544,748	544,748	9	2	95,752	95,752	3	5	1	1,278,276		
Kansas	219,583	219,583	12	12	1,036,397	1,035,397	9	1	218,085	218,085	1	1	1	529,460		
Kentucky	436,153	422,870	3	1	202,163	202,163	4	1	553,700	553,700	6	2	910,044	2		
Louisiana	159,988	159,070	1	1	6	132,646	1	1	95,094	95,094	6	6	293,580	2		
Maryland	183,547	183,547	3	3	442,459	450,666	2	2	6	393,550	180,550	1	12	800,364	1	
Massachusetts	16,388	16,588	1	1	40	446,150	446,152	2	4	50,452	50,452	3	1	1,820,605	1	
Michigan	1,169,198	1,112,969	6	1	40	1,504,745	1,504,745	4	5	301,600	301,600	1	4	878,580	1	
Minnesota	1,443,347	1,432,295	12	20	1,065,804	1,065,804	8	5	247,580	247,580	1	2	920,812	1		
Mississippi	1,308,619	305,819	4	1	656,475	656,475	9	1	142,499	142,499	1	1	641,125	1		
Missouri	1,207,124	1,206,595	6	4	1,921,553	1,466,133	5	4	181,880	159,131	1	1	1,253,824	1		
Montana	434,256	434,256	5	4	90,520	90,520	5	1	96,236	96,236	1	2	515,684	1		
Nebraska	436,040	436,040	3	14	844,621	844,621	15	1	369,818	369,818	8	24	183,237	1		
New Hampshire	75,015	74,810	1	20	116,272	118,272	3	1	71,448	71,448	1	5	106,425	1		
New Jersey	104,313	104,277	3	4	1,185,537	1,185,537	3	1	131,062	131,062	1	1	344,807	1		
New Mexico	278,937	278,937	2	4	1,192,773	1,065,823	6	1	59,140	59,140	1	1	1,049,600	1		
New York	348,049	339,475	4	6	73,664	73,664	1	1	159,441	159,441	1	1	429,993	1		
North Carolina	1,524,851	1,491,286	9	6	3,580,103	3,520,103	5	16	666,950	666,950	2	2	3,041,087	1		
North Dakota	166,042	761,917	10	3	520,009	689,769	7	10	152,195	152,195	1	26	1,050,385	1		
Ohio	417,776	415,284	5	22	470,440	457,503	5	1	200,750	188,750	4	1	726,613	1		
Oklahoma	1,372,166	1,300,912	7	2	2,401,847	2,313,804	13	1	1,705,340	1,676,340	6	3	1,824,859	1		
Pennsylvania	205,640	159,119	3	58	266,622	263,206	2	6	788,479	730,925	6	13	1,601,171	1		
Rhode Island	1,387,269	1,377,732	13	2	2,671,627	2,667,729	20	1	1,578,372	1,499,325	5	5	2,512,592	1		
South Carolina	8,222	7,406	4	3	206,703	206,703	1	3	533,412	466,625	3	3	178,826	1		
South Dakota	474,196	473,546	4	25	564,332	563,472	16	1	257,413	237,463	5	9	768,779	1		
Tennessee	284,140	231,146	2	2	300,006	291,606	3	3	1,118,708	1,118,708	6	1	925,530	1		
Texas	1,630,991	1,069,887	12	1	1,792,668	1,776,081	19	1	622,451	622,451	1	1	1,159,122	1		
Utah	133,708	133,339	1	51	83,515	82,772	3	12	96,722	96,722	1	14	392,916	1		
Vermont	143,924	143,641	12	115,533	115,533	1	1	16,478	16,478	1	1	293,090	1			
Virginia	322,483	319,995	3	2	681,109	681,109	5	3	345,248	309,869	2	2	583,613	1		
Washington	362,481	357,499	4	2	440,194	440,194	3	1	92,250	92,250	1	3	455,408	1		
West Virginia	119,730	119,730	1	3	520,862	520,862	6	8	366,430	366,430	4	1	639,695	1		
Wisconsin	825,075	809,546	6	7	523,004	523,781	4	6	621,505	620,731	2	2	43,446	1		
Wyoming	91,319	89,111	1	2	481,657	481,657	6	6	2,895	2,895	1	1	291,888	1		
Yukon-Territory of Columbia	1,466,640	1,466,640	2	2	405,282	2,193	4	2	298,213	273,144	1	1	181,412	1		
Hawaii	90,290	89,750	5	2	612,557	607,666	8	130,412	187,830	2	2	326,559	1			
TOTALS	25,944,360	25,902,731	231	47	809	35,593,792	34,261,003	271	71	158	17,162,682	16,057,607	105	26	425	435,017,388